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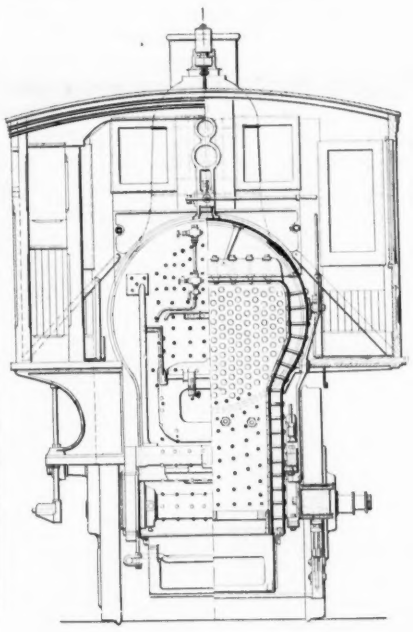
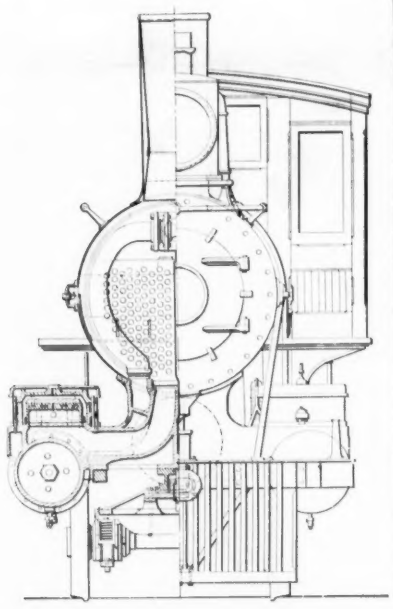
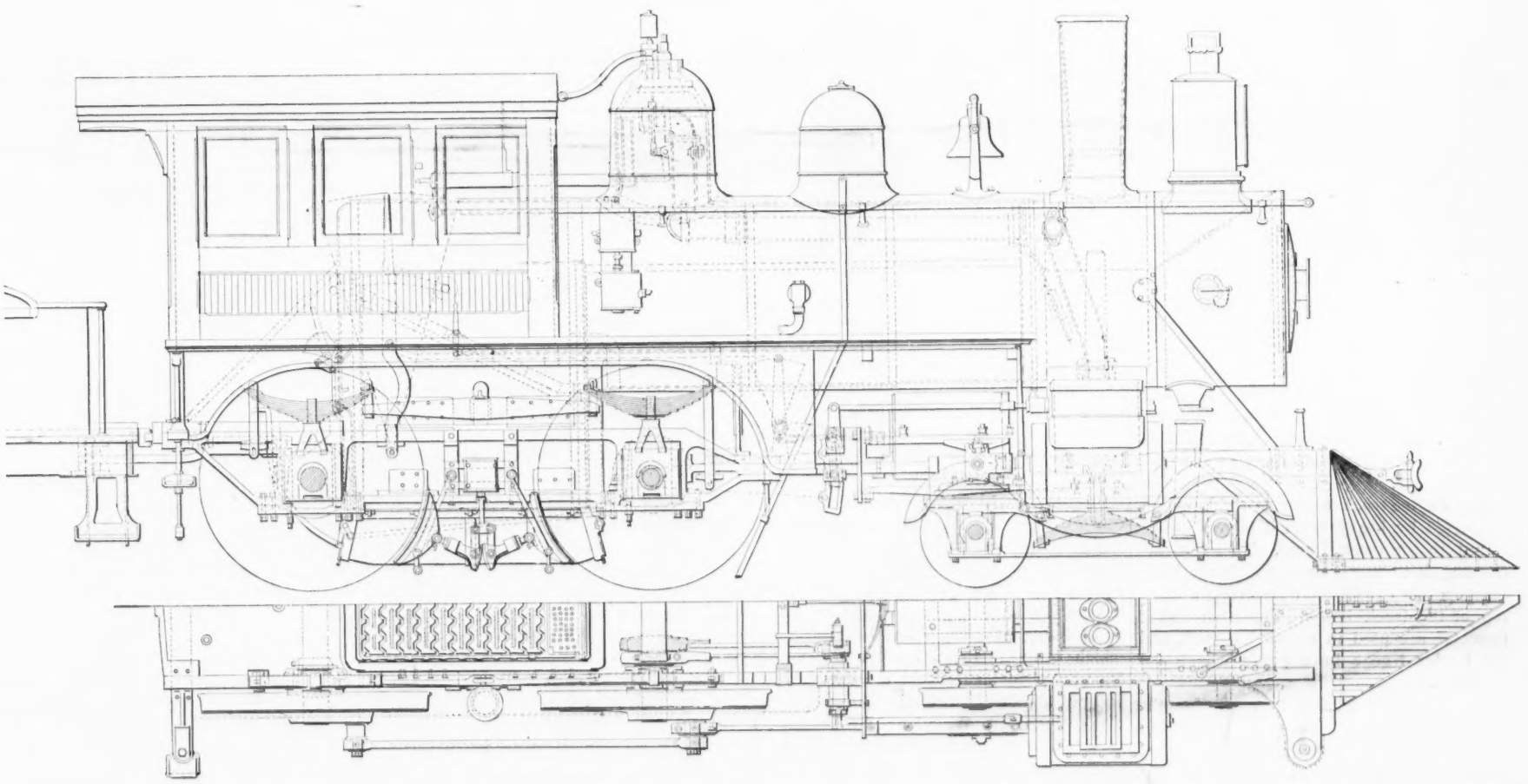
New York, West Shore and Buffalo Railway Standard Locomotive.

On this page we give three engravings of the standard bituminous coal-burning passenger locomotive class B, belonging to the New York, West Shore and Buffalo Railway Co. These engines were built by the Rogers Locomotive Works, Paterson, N. J., from the designs of the late Howard Fry, and combine many European features along with those most approved in American locomotive practice. At the Chicago Exposition of Railway Appliances, a locomotive of this pattern attracted a great deal of attention from mechanical men; and, although many disliked the departure from our accepted model of outline, the most captious critics admitted that the engine was well proportioned and admirably constructed. The generally-expressed opinion was that the engine would wear well and do her work economically.







These locomotives have been designed specially to operate the heavy, fast passenger trains expected to be run on the New York, West Shore and Buffalo Railway in the near future. It is seldom that the mechanical head of a railroad company enjoys the privilege of having his motive power prepared ahead for heavy traffic. Where railroads increase by annual sections, and the travel augments in like proportion, the locomotives are apt to grow in size just a little behind the business, the consequence being that the trains are habitually too heavy or too fast for the engines that pull them. These engines start out at nearly the maximum weight, which locomotive designers have thus far found practicable for high-speed locomotives. The engines are calculated to take a train of twelve of our heaviest coaches over a level track at a speed of forty-five miles an hour. When a demand for higher speed arises, the weight of trains will have to be reduced, and when they are made light enough the engine can maintain a speed of sixty-five or seventy miles an hour.

These engines have cylinders 18″x24″, and the driving wheels are 68″ diameter. This gives upwards of 114 pounds for each pound of effective pressure per square inch of the piston's area. The slide valves are of the Allen type, with the Richardson balancing device, and they have 1⅛ outside lap. Our master mechanics have been very backward about adopting the Allen valve, although it is an American invention and is greatly used in Europe. Its success on these engines may have a proselytizing effect. The steam ports are 1½″x16″, and the exhaust ports are 3¼″x16″. Steam enters the steam chest by two openings from the steam pipe, one in front and the other behind the valve seat. The eccentrics have a throw of 5½ inches, and the rocker arms being the same length, that is the maximum travel of the valve. Steel cross-heads are used of the alligator pattern, working between two guides, which are secured at equal distances above and below the center of the piston's travel. Cast-iron slides for working on the guides are bolted to the cross-head. The guides are remarkably substantial, and are secured behind to a yoke 1⅛″x8″. The main rods, which are 7′.2¼″ between centers, have no straps. In the front end a phosphor bronze bush is fitted into the solid rod, and the cross-head pin passes through it. The bush is hard and wears well. When lost motion produces pounding, the bush is taken out and a new one put in. The back end of the main rod is bifurcated to admit the brasses, and the opening is closed by a block, which is secured by a single bolt 1¼″ diameter. The adjusting key is in the front of the brasses. Solid-ended steel side rods are used of a type made familiar by use on the Pennsylvania, the Chicago, Rock Island and Pacific, and other well-known railroads. These rods are forged solid, then a heavy channel is planed along their sides, making I section. This gives the maximum of strength for the minimum of material.

The boiler of these engines is straight and has some peculiarities not usually seen in our locomotives. All the boiler is made of Otis steel. The outside shell is $\frac{7}{16}$″ thick, and the dome sheet ½″ thick. The smallest outside diameter of the boiler is 55 inches. The tube sheets are $\frac{7}{16}$″, the sides and back sheets of the fire-box are $\frac{5}{16}$″, and the crown sheet ⅜″ thick. The side sheets are corrugated, the depressions being only ½″ deep. The circumferential seams of the boiler are lap-jointed and are held by a single row of rivets 2″ between centers. A welt, 8⅛″ wide and 64″ long laps the bottom part of the circumferential seams. The horizontal seams are also lap-jointed with a single row of rivets, but they are strengthened throughout their entire length by a welt 8″ wide, the rivets in this being 4″ apart. An extended smoke-box is placed on all these engines. A deflector, netting and all the most approved spark-arresting appliances are used. The back part of the smoke-box is ½″ thick, and the part resting on the saddle is stiffened by an iron sheet ⅝″ thick. The extension of the smoke-box is ¼″ thick, and is attached to the back part by an iron ring 5″x1¼″.

Connection with the dome and throttle is

made by means of a pipe outside the boiler which extends back from the dome into the cab, and ends in an oblong box to which all the small steam pipes are connected. The injector steam pipes, the blower, air brake, throttle, etc., are attached here, preventing the necessity for cutting into the boiler head in all directions to make steam-pipe connections. The throttle rod extends through this steam box and pipe to the dome. No water-gauge cocks are put on these engines, but they are provided with two water-gauge glasses, one on the boiler head, the other at the side of the boiler in front of the engineer's seat. This is a doubtful improvement. The average locomotive runner will get deceived more readily with a glass than he will with gauge cocks. There is some temptation to be satisfied with the appearance of water in the glass without opening the try cocks to see if the water is genuine. The water glasses on these engines are provided with an automatic valve which shuts off the steam and water should the glass break. This stop valve is made in a simple way so that in can easily be examined or cleaned. It is a much-needed improvement on water glass cocks, and like many other conveniences about these engines is got out by John Player, mechanical engineer of the road. Water is fed to the boiler by two No. 8 Sellers injectors, one located in each side of the cab. One injector is found sufficient to feed the boiler when the engine is working its full power.

In the fire-box, four water tubes extend from below the bottom row of tubes diagonally up to the crown sheet, and are used to support a brick arch. Plugs are provided in the outside shell of the fire-box opposite to the opening of each tube, so that they can be cleaned out every time the boiler is washed out. By attending to this duty no trouble is experienced with the tubes burning out. A good feature about this engine is the ash pan which is of heavier iron than ash pans are usually made from, and admits of the dampers being fitted so that they will shut close. More coal is annually wasted in this country through defective ash pans than railroad managers are aware of.

The length of the fire-box is 70½″, its narrowest width is 34½″, and its depth increases from 71¾″ to 74¾″. The heating surface of the fire-box is 111 square feet. There are 188 tubes 2″ outside diameter and 11 feet long, giving a heating surface of 1083 square feet. The grate area is 16.48 square feet. This gives a proportion of 1 foot of grate to 72¼ square feet of heating surface. The total heating surface is 1194 square feet.

The main bar of the engine frames is square iron 3¾″ deep, and the under bar is 3½″x2¼″. A heavy brace connects the frames where they slope down in front of the back driving boxes.

The engine truck center is rigid, and is supported by heavy cross bars which are bolted to the truck frame. They transmit the weight to the springs which are hung between two equalizers whose ends rest on top of the truck boxes. Paper wheels 33″ diameter are used in the engine truck, and the tender trucks have paper wheels 42″ diameter.

One main reservoir is used for the air brake, and it is hung to the frames between the cross-head guides. Driver brakes are provided on all the engines, and they are connected to the automatic attachments of the tender brake, which brings them into action in making all stops. Cocks are provided to cut off the driver brakes when they are not wanted.

Whatever degree of beauty these engines possess is entirely independent of intentional ornamentation. The cab, dome, sand-box and smoke-stack are devoid of mouldings and are supposed to represent the severely æsthetic style in locomotive architecture.

A few of the leading dimensions not already mentioned are:

Total wheel base	22′ 9½″
Rigid wheel base	8′ 6′
Distance between centers of cylinders	6″ 5″
Thickness of pistons	5″
Diameter of piston rod	3″
Size of driving axle journal	7½″×8″
" " main crank pin	5½″×4¼″
Side rod pins	3¾″×3½″
Weight of engine in work. order	95,000 lbs.
" on drivers	63,000 lbs.

The Thompson Improved Indicator.

The requirements of high-speed engineering call for the highest attainable accuracy and precision in the manufacture of the steam-engine indicator, as well as the reduction of the weights of the moving parts to a minimum. The Thompson Indicator was the first one brought out after the Richards, and it was quite generally believed at the time that the reduction in weight of these parts had been carried as far as was desirable. But comparing the Thompson instrument as originally made with the standard Thompson improved instrument as at present made, and shown in Fig. 1, the difference in the weight of these parts is seen to be nearly as great as that between the original Thompson and Richards instruments.

Some of the advantages claimed for this instrument in its improved form, are that it is simple in arrangement, as well as neat in design; that the moving parts are so light that reliable diagrams can be taken at any desired speed, and at a pressure as high as 500 lbs. per square inch, and that while this adapts it for the tendency to high speed and pressures it equally fits it for accurate work on large slower-running engines.

The coiled spring in the paper cylinder for regulating the tension for different speeds is so arranged that it may be taken up as little or as much as may be desired; that is, it is not

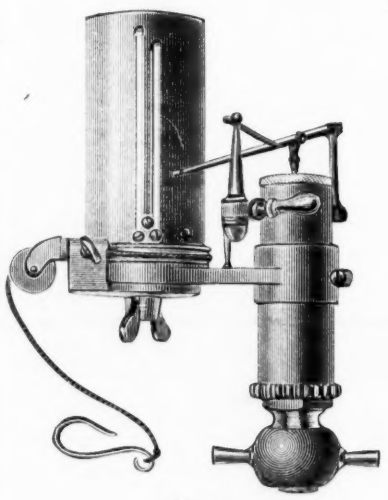


FIG. 1.

necessary to take up an entire coil, but only such part of it as may be desirable. This provides for obtaining the exact instead of the approximate tension required to suit the varying conditions under which the instrument may be used.

The pressure springs are very readily changed without the use of a wrench or screw driver. This is done by unscrewing the milled nut at the top of the steam cylinder, and taking out the piston with arm and connections. Then disconnect the pencil lever and piston by unscrewing with thumb and forefinger the small knurl-headed screw which connects them, remove the spring from the piston, substitute the desired one, and put together by reversing the operations. The springs all provide for 30″ vacuum, and are made for any pressure from the lowest practicable to the highest desired. The present practice is to test the springs after tempering, by placing them in an exaggerated condition of working; that is, by subjecting them to intermittent compression and extension, as if in the indicator, except that the compression and extension is carried somewhat beyond the working limits, and at the rate of 1,500 times per minute. After this, if the spring stands this test satisfactorily, it is carefully "scaled."

In the connections between the spring and the pencil motion the parts have been lightened as much as is consistent with preserving sufficient strength, and further simplified in their detail.

Referring to the parts that move in connection with the paper, the paper drum has been lightened more than one-half over that formerly used. The spring case has been carried down towards the bottom of the paper drum, by which the moving parts have been much lightened and the action of the drum spring brought nearer in line with the action of the cord.

In the old instrument, the stop for the pencil lever was in the sleeve, and out of sight as well as difficult of adjustment. In the new one, the stop is by means of a post and adjustable screwed handle with a check nut, by means of which the most delicate adjustment of pencil pressure may be almost instantly made, and will always remain under the eye of the operator.

The new lever, Fig. 2, is of ample strength, although only a fraction of the weight of the old one. It is of oval section, calculated to secure the needed strength with the minimum weight. The outer end is a mere shell, sufficient to hold a pencil lead; the bearing at the piston-rod connection is of respectable length, while the bearing at the fulcrum end is shortened and otherwise lightened by reducing the diameter. The reduction in the weight of these parts, which must be started and stopped twice besides moved through considerable distances in about the time of the half-revolution of an engine running from 200 to 500 revolutions per minute, will be appreciated even by those who have never demonstrated its importance.

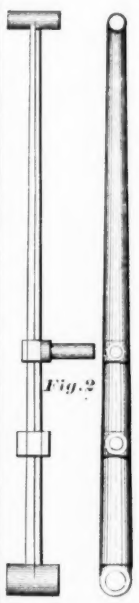


FIG. 2.

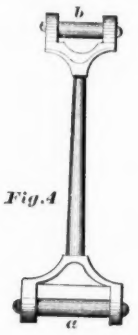


FIG. 4.

FIG. 3.

Fig. 4 represents the improved vibrating fulcrum. This is of steel, very light and strong. Small steel screws, *a*, *b*, are used instead of the large pins formerly employed. This makes a much simpler and neater arrangement, the screws not being liable to work loose when the instrument is in use. Steel screws have also been substituted for pins in other cases where the former were used.

One of the more recent improvements, and one which to a large extent obviates the use of carrying pulleys, is represented in Fig. 3, and is the subject of a recent patent. It consists in using a single guide pulley instead of two, the single pulley being adjustable to lead the cord away from the indicator in any desired direction. With the two pulleys the direction in which the cord could be led was limited, while with this it can be led anywhere from the entire circle of 360°, up or down or at any angle. This is accomplished by mounting the pulley in a separate piece, having a trunnion or journal through which is a hole for the cord. This journal is mounted in a bearing and can be revolved to any point in the circle, carrying with it the pulley. It is held in the desired position by a thumb-screw, which enters a circumferential groove around the journal, thus avoiding any danger of its being pulled out of position by the action of the cord, or of the screw marring the journal so that it cannot readily be turned as desired.

The pulley is mounted so that the center of the groove at one side is tangent with the hole through the journal, so that in whatever direction the guide pulley is turned the cord is led fairly to the groove in the paper drum. The advantages of this device (which may be applied to indicators already in use), not only for radically changing the direction of the cord, but for making small changes, the desirability of which are only found when the indicator is in position, are apparent. Thus, the steam pipe, or some other part, may be in the way, and, in order to prevent distortion of diagram, it may be desirable to change the direction of the cord, or it may be convenient to do this for a variety of purposes.

While the most important effect of lightening the parts of the indicator has been to prevent undue vibration and insure smoother work, incidentally it has reduced the weight to be carried around and the size of the box in which to carry it. Altogether, the improvements made in this instrument represent the suggestions of experience in the manufacture of indicators and the experience of experts in their use. These improvements represent not only simplifying and lightening the parts, but the judicious selection of material and the refinement of workmanship, together with the employment of improved special tools and appliances.

When desired, the instrument is made with a larger drum—2½″ diameter—for taking longer diagrams. The detent motion, consisting of a pawl and stop, by the use of which the paper cylinder can be stopped and a change of cards made without unhooking the cord, is also furnished when required.

The manufacturers of this instrument are the American Steam Gauge Co., 36 Chardon Street, Boston, Mass.

Objections to Inside-Connected Locomotives.

When Dr. Williams, of the Baldwin Locomotive Works, Philadelphia, was in Europe lately, he received an order to build some locomotives for the Argentine Republic. It now seems doubtful if the company will build the engines owing to objectionable features in the specifications. European engineers have charge of the railroads where the locomotives are wanted, and they call for engines built after European designs, with inside connections and wrought-iron wheels. The Baldwin people do not care to build locomotives of that kind.

They had once a question of the same kind come up in regard to an order for locomotives for the Russian government. Inside connections were called for, and the officers of the Baldwin Works prepared evidence to show that outside-connected engines were preferable to those with inside connections. They proved to the satisfaction of the Russian government, that they could supply a set of cylinders complete and ready to put on to an engine for the expense it took to face the valves and seats of an inside-connected locomotive. This may seem a startling statement, but when one reflects that it takes about two weeks' time to face the valve seats of inside-connected engines when they are badly worn, the calculations of the expense will not appear excessive. The loss of service alone of the engine will reach nearly $300. The Russian government took outside-connected locomotives when the matter was properly considered.

It appears badly-advised policy to introduce inside-connected locomotives into a country where skilled mechanics are so scarce as they are in the Argentine Republic. Should a crank axle break, the engine would be rendered useless till they could send to Europe or the United States for a new one. Most of new roads need all their engines in active service as much as possible, and it is very important that their construction be such as will admit of prompt and easy repairs. Inside-connected locomotives are badly adapted to run on a rough track under any circumstances; they are inconvenient on a new road, because ordinary running work cannot be done to them unless they are standing over a pit, and they often need repairs which only first-class machinists can do.

Death of a Celebrated Metallurgical Engineer.

On November 20th Dr. Charles William Siemens, so well known as the inventor of the regenerative gas furnace and other important mechanical devices, died of rupture of the heart. Dr. Siemens was born in Hanover, and belonged to a family that displayed surprising inventive and mechanical ability. He enjoyed the advantage of a thorough course of technical education in German technical schools and university, which greatly aided him in surmounting the difficult physical problems which continually received his attention. Directly after finishing his university course, he entered engine works as a pupil, where he received mechanical training for about a year. Shortly afterwards he went to England for the purpose of introducing inventions got out by

himself and brothers. He subsequently settled in England, and became a naturalized citizen of that country. All the honors which that industrial country is beginning to bestow upon its leaders in scientific research were freely extended to Dr. Siemens. Nearly all scientific societies in Great Britain had honored themselves by electing him as a member. He had been president of the Society of Mechanical Engineers, of the Society of Telegraph Engineers, and had also been president and took a lead in the management of the British Association, and he had received the degree of doctor from several universities, among which was high-toned Oxford. To complete the list of honors, Queen Victoria conferred upon him the title of knighthood.

High honors of this description are not conferred in England upon aliens, unless they display extraordinary claims to distinction. Besides being the inventor of a metallurgical process which has immensely improved steel industries everywhere, Dr. Siemens was reputed to be the ablest electrical engineer in the world. He invented the double air-cylinder, the chronometric governor, and a host of minor appliances that have become popular in the industrial world. While Dr. Siemens was thoroughly worthy of all the honors conferred upon him, it is creditable to Great Britain that the nation displayed the liberality of giving honor where it was due.

The Milling Machine—Its Construction and Uses.

By JOHN J. GRANT.

ELEVENTH PAPER.

In making cutters for the milling machine, the first thing required is good stock, and the next a good workman—one who has good judgment; and if he has a little previous knowledge of the art it will not come amiss, as it is easier to imitate than to devise. The steel should not be over-annealed. A great many workmen think that it is necessary to have the steel re-annealed after the first chip is taken off. This I not only do not consider necessary, but, on the contrary, a positive injury to the steel. If the steel is once annealed after working by the smith, it is sufficient. In fact, where practicable, I would recommend that the stock be cut from the bar of round tool steel, and worked without annealing. I think I speak knowingly—certainly from a good many years' wrestling with about all kinds of tool steel in the manufacture of taps and dies. The cutter should be chucked two or three-thousandths of an inch under the size of the milling machine arbor, to allow for lapping out to size after hardening, and unless the cutter is less than $\frac{1}{4}''$ wide, it should be chambered out $\frac{1}{64}''$ deep to within about $\frac{1}{32}''$ of each side. This will make the grinding or lapping out much easier, besides insuring a much better fit at the outer ends of the hole.

In turning a cutter for common milling, no care need be used to bring it to a perfect size. When the cutters are for gangs, the size is very essential, as the labor in grinding and adjusting is materially lessened when they are accurately turned. In cutters of a width of face less than 1", I would recommend them to be cut straight; above that width, to be cut spiral. Of course, there are exceptions to this rule, as where two cutters of the same diameter and made to adjust for width are run together. In this case they may be cut spiral, one right and the other left-hand. Always cut the face of the tooth so that it will lead to the center. It is a mistaken idea to cut teeth hooking. Fig. 1, at *C*, shows the best form of cutter for cutting the teeth of spiral cutters, and is kept in stock by the makers of the Brown & Sharpe Universal milling machine. • As will be seen, the cutter has two angles—one of 40° and one of 12°. The distance, *a*, that the point of this cutter should be set back in cutting a spiral cutter is about one-tenth the diameter, *B*, of the cutter being cut. This form of cutter will not drag when cutting spirals.

For cutting straight cutters, a cutter as shown in Fig. 2, having all the angle on one side, and cut on the face as well as on the angle, should be used. These cutters are also used to cut the teeth on the face of cutters, and should be made with angles from 10° to 45°, to suit the cutter being cut. Do not make the root of the tooth sharp, as they are more apt to crack in hardening at this point. The amount of round at the bottom should be in proportion to the size and number of teeth. The teeth, as a general rule, should be coarse, that is about six per inch, diametrically. Cutters in all cases should be made as small as possible for the work they are intended to do, in order to diminish the torsional strain upon the arbor, and to prevent chattering. The teeth should be cut $\frac{1}{32}''$ wide at the points, and if the cutter is kept sharp, and a roughing and finishing cut be taken, no farther finishing will be required.

In cutting the teeth on the face of a cutter, a handy tool is shown in Fig. 3. The shank should be fitted to the spindle of the elevating head, and the outer end turned to the size of hole in the cutter. A small hole, say about $\frac{5}{16}''$ to $\frac{3}{8}''$ diameter, is chucked through, and the end is reamed tapering. A plug that will drive about $\frac{1}{8}''$ is fitted to this hole. Holes $\frac{1}{4}''$ diameter are then drilled at *B*, and the arbor is split from the outer end down to *B*. When the cutter is on the arbor, the plug is driven in tight, which expands the arbor sufficiently to hold it firm. This affords a clear space across the end, and facilitates the cutting. In small sizes it is especially handy. As there are but four sizes of holes in milling cutters, the outfit is not expensive, and with ordinary care will last a life-time.

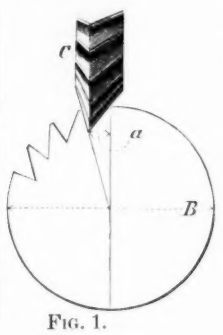


FIG. 1.

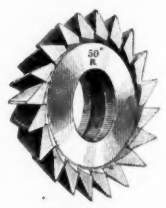


FIG. 2.

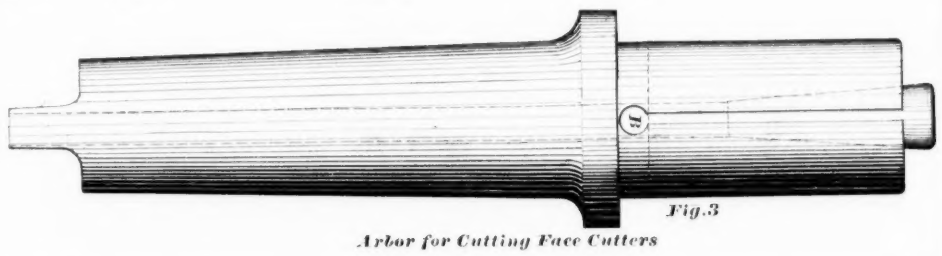


Fig.3

Arbor for Cutting Face Cutters

In hardening cutters a lead bath is the best and safest to use. If there are but few cutters to harden, a common black lead crucible will do. Fill this with old lead, melt and heat to a bright red color. Immerse the cutter in this, and it will heat very evenly, and will not spring. To cool the cutter plunge it into a bath of water containing about ten per cent. of oil of vitriol. As soon as the vibration ceases to be felt withdraw from the bath, and cool off in oil. If proper care is taken there need be no broken or cracked cutters. The holes should now be lapped out to the standard size, which may be done in the following manner:

For holes $\frac{7}{8}''$ or 1" diameter a mandrel of about $\frac{5}{8}''$ diameter at its largest end is made tapering about $\frac{1}{4}''$ to the foot. For the general run of cutters it should be about 10" long. A groove or spline should run the entire length, to prevent the lead from turning. Cast the lead around the mandrel, and turn it off to the required size. For grinding use about No. 60 emery. As the lap wears small it is only necessary to drive the mandrel in and expand the lead. Be careful not to get the hole above standard size, as it will cause it to run out of truth, and as good work cannot be done as when everything is perfect.

In grinding the teeth of cutters too fine a wheel should not be used, as it is apt to heat the extreme edge of the cutter and draw the temper. If a very fine edge is required a few passes of a free cutting oil stone will be of benefit.

To conclude this article, I will say that I have often wondered why the makers of universal milling machines do not publish, for gratuitous distribution, a complete manual or guide for the use of the machine. These would find their way into the hands of workmen, who, by the way, are generally the first to agitate the introduction of improved methods of doing work in the shop. I mean the workmen with brains, and not those hampered by the desire to do work as their grandfathers did it before them. It would seem to me that the return for the investment in such a book or circular would pay the manufacturer who will be the pioneer in it a very handsome profit in increased sales.

Meeting of the New York Car Builders' Club.

The monthly meeting of this club was held in the rooms, 113 Liberty Street, New York. The subject for consideration was "Tests of Material Used in Construction of Railroad Cars." President Geary presided, and intimated that he had arranged for a paper to be read on testing machines by the representative of a manufacturer. In the paper which followed, the merits of certain testing machines were zealously portrayed and their advantages expatiated upon. The writer of the paper assured the meeting that the production of car wheels and other portions of cars had been rendered more uniform by the systematic use of testing machines.

President Geary said that the car builders, at their meeting at Buffalo, recommended the testing of car wheels by a good machine. Manufacturers deprecated the idea of a test being necessary. But they got using the test, and the wheels were improved.

Mr. Wilder doubted if tensile tests alone were satisfactory. Cold short iron would stand a high tensile strain, yet for some purposes it was worthless. Some years ago they were receiving bar iron, which was not giving satisfaction. He polished cross sections of several bars, and then subjected them to acid, and each showed a distinct rail section. The iron had been rolled out of old rails. They subjected a certain number of all axles received to a drop test, and when they began this system manufacturers could not make axles to stand such a severe test. He insisted on the practice, however, and he now finds that axles seldom break under the test.

President Geary considered that the introduction of systematic tests had been the means of improving the quality of axles, so that they could carry the prevailing heavy loads with safety. Two years ago his buffer springs would not stand more than 5,000 pounds load. Owing to the influence of regular tests, he now gets springs of the same weight that stand 22,000 pounds. He thought that some railroad companies wanted to make the tests too scientific.

Mr. Forney thought that in the matter of testing material it was very important that capable men should be looking after the operations. If competent men were employed—men who were capable of recording exactly all the conditions under which the tests were made and the results obtained—they would be accummulating valuable scientific knowledge. Herbert Spencer defines science as accurate knowledge, and their work in the way of tests would be accepted as valuable contributions to science should they be properly made.

Work in Locomotive Shops at Paterson.

Complaints are rife round the locomotive works in Paterson, N. J., of work being scarce and of orders for new locomotives coming more slowly than they have done for three years. In the Grant works a few men have been discharged, but the Rogers and Cooke works still find work for all their men, although they do not expect to keep a full force going all through the winter. The Rogers Works are still working on the New York West Shore and Buffalo locomotives, and they also have engines on hand for the Missouri, Kansas & Texas, the Texas Pacific, the New Orleans, Texas & Pacific, the Cumberland Valley, besides some for Chili and Costa Rica. They are building some Argand boilers with a combustion chamber ahead of the fire-box which has provision for admitting a supply of air from the outside to complete the process of combustion. These boilers are for stationary engine or heating purposes. The Grant Works are engaged mostly on a group of heavy consolidation engines for a Southern narrow gauge road.

Good Quality of American Shipbuilding Iron.

Several gentlemen connected with British iron ship building interests recently visited the ship building yard of William Cramp & Sons, Philadelphia. While there they tested the tensile strength of some pieces of the iron cut off ordinary ship plates, and they expressed themselves surprised at its high quality. They acknowledged that the iron was of a quality very much superior to anything commonly used in the Tyne or Clyde ship-building yards. This may indicate that the minority report of the Advisory Board of our Navy Department was well founded, when it said that the ship-building iron used in Great Britain was of one quarter less tensile strength than the iron manufactured in the United States. It will be remembered that this report gave rise to severe animadversion in some quarters at the time it was made. The majority recommended the use of steel for ship-building purposes, a change which was objected to by the minority as unnecessary. They held that the use of steel for this purpose was brought into favor by the inferior quality of ordinary British iron, and contended that our iron plates are the best material for ship-building purposes.

New Use for the Westinghouse Air Pumps.

From the *Engineer* we learn that Mr. Stroudley, Locomotive Superintendent of the London, Brighton and South Coast Railway, England, has made novel use of the Westinghouse Air Pump on a locomotive which he has recently designed. Compressed air from this pump is used to reverse the engine. A small cylinder with a piston and rod is connected with the reversing gear and a three-way cock admits air behind the piston which forces the reverse lever into back motion. Having no counter balance weight or spring the motion goes into forward gear by its own weight, and is cushioned by the air in the reversing cylinder.

This engine is provided with a peculiar form of pump for feeding hot water, and the Westinghouse brake reservoir is drawn upon for a minute supply of air to keep the pump from pounding.

An auxiliary feed-pump for supplying water to the boiler, when the engine is not running, is attached to the Westinghouse Air-pump, and is worked by the air direct. Means are provided for cutting off the air passage to the main reservoir when this operation is going on.

Personal.

George A. Barnard has severed his connection with the Hartford Engineering Company and taken control of the Eastern business of the Buckeye Engine Company, of Salem, O. His present address is 69 and 70 Astor House, New York. Mr. Barnard was formerly connected with this company, and is well known to the steam engine trade.

Clocks and watches are now being made that mark the hours from one to twenty-four. Perhaps double dials would be best, at present.

Growth of the Train Brake.

By ANGUS SINCLAIR.

URGENT NEED OF A CONTINUOUS BRAKE.

Railroad traffic had developed into such great proportions on many American railroads by the year 1860, that common prudence demanded the devising of systematic means to guard against violent accidents in the ordinary movement of trains. As the roads were still all devoid of any proper signal system, it was becoming daily more urgent, that powerful continuous brakes should be adopted which would always be sufficient to keep trains under easy control; or that a well arranged method of station signals to protect trains should be introduced without delay. The necessity for better safeguards was eloquently advocated by the most far seeing leaders of public opinion, but their recommendations were for years ignored by those who alone could carry out the desired reforms. And at this time other momentous events distracted the public mind, so that little attention was devoted to domestic matters. The cloud of the approaching civil war obscured the urgency of ordinary internal improvements, and individual safety was neglected during the conflict which threatened to disintegrate the nation.

INCREASE OF TRAIN ACCIDENTS.

But while the nation's troubles left railroads for a time without the salutary influence of freely expressed public opinion, events recurred at brief intervals which prevented the people from forgetting that railroad travel was environed with menacing dangers. Fatal accidents to travelers were becoming alarmingly frequent, and minor casualties were often overshadowed by appalling disasters which in many instances were entirely preventable. When the killing and maiming of men is confined mostly to railroad employes, the general public seem to endure a great deal of bloodshed with calm fortitude, as can be seen in the prevailing apathy regarding the slaughter that goes on unceasingly through defective couplings; but where the killing becomes promiscuous, public indignation is apt to wax violent.

PREVENTABLE TRAIN ACCIDENTS.

But in regard to railroad accidents, the public were really long-suffering before they murmured. To enumerate the events which led public opinion to become so clamorous, that railroad companies could no longer ignore the demand for safety appliances, would be to compile a long weary record of death in some of its most hideous forms. As far back as 1853 an express passenger train was approaching a drawbridge near Norwalk, Connecticut, at the rate of fifteen miles an hour. When over 400 feet from the bridge, the engineer perceived that the draw was open, but with the defective appliances in use the train could not be stopped, so it dropped into the chasm. The water was about twelve feet deep, and most of the train piled into a confused mass above the engine. When the wreck was cleared up, it was found that 46 persons had lost their lives, while a great many more were severely injured.

A characteristic defect of the old hand-brake was its being most liable to fail when most urgently needed. In ordinary stops the brake would do its work satisfactorily when properly manned. But in case of an impending accident, the application of brakes had to be called for, and the time which should have sufficed to make a stop, was often wasted before a brake wheel was turned. Valuable seconds that count as throbs of life, precious moments that gauge the distance between life and death, were often thrown away by brakemen trying to see what was the matter. Again when derailment took place suddenly from any cause, brakemen could not get out on the platforms to apply the brakes, the consequence being that partly derailed trains tore along without control, smashing cars to atoms with terrible consequences to the occupants. An impressive example of this kind happened near Port Jervis in 1858. As an express train from New York was pushing along on a perfectly straight track, a broken rail threw the hind car off the track. The swaying and plunging of this car over the ties, pulled the next car from the track, and after pounding along for four hundred feet the two broke away from the rest of the train and rolled down an embankment. The other part of the train ran half a mile before it was stopped. Six persons were killed and fifty severely injured.

But the most horrible accident of this character happened at Angola, on the Lake Shore & Michigan Southern Railroad, in December, 1867. As the east bound express train passed Angola at a speed of thirty miles an hour, the last car of the train jumped the track on one of the station frogs. About 1,200 feet further on was a high bridge. The derailed car pounded over the ties till this bridge was reached, when it broke away and plunged down into a ravine fifty feet below. Only three persons escaped from that car alive. It instantly took fire and burned up forty human beings who were confined a struggling mass in the end of the car. The front end of this train ran half a mile before it was stopped. A terrible storm of indignation followed this accident, and the railroad company was accused of slaughtering people wholesale on account of being too penurious to adopt proper brakes.

THE PUBLIC PRESS ON TRAIN ACCIDENTS.

In the end of January, 1864, a writer in the New York *Tribune* calculated that over one thousand persons had lost their lives during the previous year by railroad accidents, and he complained that the increase of population was not rapid enough to admit of such a loss to continue from year to year. Two serious accidents with which the year opened promised to make 1864 more sanguinary than 1863 had been. This writer had great faith in the Creamer brake as a means of preventing accidents, and called for its extended use. The Creamer brake although superior to the common hand brake, did not however meet the demands for a brake that would be prompt and reliable under all circumstances. This fact was sadly demonstrated at New Hamburg, on the New York & Hudson River Railroad, in February, 1871. On the evening of that day, a freight train stopped on a bridge with a car off the track. A passenger train came along, and was within six hundred feet of the disabled train before the danger signal was perceived. The Creamer brake was sprung and the engine reversed, but the train could not be stopped, and it dashed into the freight cars. Part of the latter were loaded with oil which instantly took fire, turning the worst kind of a railroad accident—a collision on a bridge—into a holocaust. Twenty-one persons were killed, and a great many severely injured.

PUBLIC BELIEF THAT BRAKES COULD BE IMPROVED.

All the accidents mentioned were preventable, had the braking facilities been equal to what have since come into everyday use. Till the Westinghouse appeared, no brake had been developed that would stop a train running thirty miles an hour within 600 feet. Persons acquainted with physical science readily calculated the resisting force required to stop trains at the prevailing speeds within distances that would have prevented the most appalling accidents. The power needed was by no means stupendous, and it seemed humiliating to reflect that mechanical science had failed to provide the means of its application. Many people had witnessed how quickly a train moving at a high velocity could be safely stopped by running into a heavy snowbank, and they naturally reasoned that when an impediment could stop a train running forty or fifty miles an hour within 200 or 300 feet without shock or damage, an approximation of that result ought to be achieved by mechanical means.

By the time the Westinghouse atmospheric brake was invented, several of the most intelligent railroad managers had become prepared to accept any good continuous brake. Among the numerous inventions that had previously claimed railroad patronage, no brake possessed the elements that are now considered essential in a good train brake.

DEFECTS OF EARLY CONTINUOUS BRAKES.

Several attempts had been made to operate brakes by steam, but the modes of application were impracticable. Steam cannot be made to pass through pipes on a train and then be used successfully to operate brakes on the separate cars. The early steam brakes were mostly used to operate chains by means of a cylinder and piston, the chains extending throughout the train and connecting with the various brake levers. This would seem a feasible way of operating a continuous brake. Like many other specious devices, however, this brake needed the searching ordeal of practice to develop its inherent weaknesses. A train of cars is of varying length. When all the bumpers are compressed, it is shorter than when the engine is pulling with all the drawbars distended. This "stretching" of the train proved fatal to the success of chain brakes. The Loughridge brake, patented in 1864, worked on this principle; and, although several ingenious devices were applied to compensate for the stretching of the train, that source of weakness made the brake unreliable. When the chain was not strong enough to stand the pull of the whole train, it was always liable to get broken while doing its work. Any mechanic will readily perceive other objections to a chain brake where every link is a source of weakness. Had the chain brake possessed any inherent merits, they would have been developed by Loughridge, who was thoroughly competent to make the best of anything relating to train brakes.

Practical railroad men had lost confidence in the Creamer brake. To act as an emergency brake, it had to be prepared by brakemen winding up the springs. This duty was often neglected, and when an emergency arose the brake frequently failed to respond. Several serious accidents happened under these conditions, and the truth became evident that a continuous brake which is liable to fail in case of an impending collision is worse than no brake.

TRAIN BRAKES IN EUROPE.

Up to 1870 nothing of any consequence had been done in Europe to develop a system of continuous brakes. There, perfection of a station signal system was regarded as the most efficacious means for preventing train accidents. As early as 1832 George Stephenson perceived the danger likely to result from defective control of trains, and he invented and patented a bumper brake which he intended applying to each vehicle on a train. The retarding power might be blocks impressed on the wheels or sledge shoes applied to the rails. In this case George Stephenson attempted a mechanical feat which vanquished him. His brake was a failure. The subject appeared to receive considerable attention from both father and son, for in 1833 Robert Stephenson patented a steam brake which was to be applied to the locomotive. It was expected that this brake would check the momentum of the train sufficiently to bring the bumper brake into action. But it did not succeed. The trouble was that the bumper brake could not be reinforced into use because its weak points were too numerous.

The sledge or slipper brake received considerable attention in Great Britain from different mechanics, but it never attained any success as a means of stopping trains. Appliances that were used to grasp the rail were dangerous because they were apt to get broken by striking a frog or crossing with the result of making the wheel jump the rail. If it was merely a plain block sliding on the rail its retarding power was of no practical value.

On some British railways the Clark chain brake was used, it worked through the wheels of the guards van (as brake cars are called there) being made to carry a friction wheel which wound a chain and tightened up the brakes on the other vehicles. It was cousin german to the Loughridge chain brake of this country, and of about the same value.

BRAKES IN FRANCE.

In France Chatelier, an eminent railway engineer, was early in the field experimenting with the cylinders of the locomotive as a means of applying retarding power to stop the train. His inventions consisted principally of making provision for preventing the cylinders and valve seats from being injured by the suction of hot gases and cinders when the engine was running in reverse motion. When a necessity for stopping suddenly arose, the locomotive was reversed and a jet of water was injected into the exhaust pipe forming a vapor which filled the cylinders and obviated suction from the smoke box. This brake is now used as supplementary to the automatic air brake on the Denver & Rio Grande Railroad.

ORDINARY TRAIN BRAKES IN GREAT BRITAIN.

For ordinary braking purposes the hand screw brakes were used on nearly all trains in Great Britain, and, like the hand chain brake in America, they had become time honored, and conservative Britons did not like to hear a murmur questioning their efficiency. Train brakes all over Europe were decidedly behind those of America, even before the introduction of continuous brakes. On the railways beyond the Atlantic, brakes were confined to certain vehicles equivalent to our baggage and express cars. With passenger trains, a brake van was at each end of the train, and their retarding work was aided by a brake on the tender. When these three brakes were applied and the engine reversed, all the available means of stopping the train was in operation; but if the train were running over forty miles an hour when the brakes were applied, it would run, under the most favorable circumstances, about half a mile before stopping. After exhausting all the retarding power at their command, in many instances train men would have a minute or more to watch the train rushing to destruction, while they would be as powerless to prevent a catastrophe as they would be to avoid going over the Falls after entering the Niagara rapids in a boat without oars.

Reduction of Force on the Northern Pacific Railroad.

General Haupt, General Manager of the Northern Pacific Railroad, resigned his position when he received an order from New York to discharge 600 men. In regard to the matter he says:

"The whole difficulty arose from the capitalists and syndicate expecting immediate returns on the completion of the road, whereas it was necessary that the country should be settled and properly developed before the returns could be very large. The road was really constructed in a very superior manner for a new road, but much remains to be done before it could be considered completed. By suspending this work at this time the operating department is necessarily embarrassed, while the necessity for the construction is only postponed. There is no real economy in so doing; but, on the contrary, true economy would dictate that the work should be done at the proper time as well as in a proper manner. The conditions on this line are peculiar in this respect, that the only period in the year when the work can be done on the track is the few weeks intervening between the drying up of the water in the spring and the commencement of harvest, at which time all section hands leave for the harvest fields. If the work is not done during July in putting the track in order, it must be postponed for another season; but, unfortunately, this period is that of the minimum business and receipts, and the reduction of receipts and increase of expenses. At the same time it probably created the impression that the management was not sufficiently economical, and led to an order to cut down the forces in every department. Feeling that I could not comply with the expectations of the New York capitalists, of making brick without straw, and could not do credit to the management without sufficient means to work with, I preferred to retire altogether.

"I feel much gratified with the results that

have been accomplished during my administration. The order and discipline that have been introduced, the regularity of operations, the comparative freedom from accident, and the efficiency of administration in all departments have been noticeable. I am also satisfied that all the measures that were adopted were in the direction of economy, and that nothing was undertaken that must not be done sometime, and probably under much less favorable conditions."

An incident happened on the Portrush electric railway in Ireland lately, which draws attention to what, under certain circumstances, might prove a serious obstacle to the successful operating of such railroads. No great undertaking can be properly set going in the British Isles till some sprig of nobility has taken part in its inauguration. The Portrush railway was to be inaugurated by Earl Spencer, Lord-Lieutenant of Ireland. Everything was in readiness to make a ceremonial run with tremendous eclat; but when they wanted to start, it seemed that the spirit of Fenianism or some other sentiment unfavorable to the aristocracy had got into the motor, for it would not start. Consternation reigned supreme among the officials for a time. The motor seemed all right, the connections were intact, and the question was, why in the name of lightning won't the thing go? It was finally discovered that some joker had connected the electric rail with the earth by means of a spike. Imagine a whole division of a railroad being paralyzed at any moment by such a simple expedient as this!

Bedding In and Rolling Over.

BY THOS. D. WEST.

Bedding in and rolling over patterns in moulding have each their special advantage. As a general thing, rolled-over moulds produce the smoothest castings, and are the simplest to construct, the reverse being the case with bedded-in castings. A moulder that cannot successfully turn out a good general run of castings by rolling over need never attempt it by bedding in. The writer is well aware that there are castings that cannot be as reliably made by rolling over as by bedding in, but this fact does not change the truth of the statement made. It will be acknowledged by all practical moulders who have had experience in both rolling over and bedding in that to do general bedding in requires higher skill than rolling over. Any shop that does most of its moulding by rolling over can get along with less skilled mechanics than where the patterns, as a general thing, are bedded in.

When a moulder is furnished with nice patterns and flasks, the requirements are like those of machine labor; the physical and not the mental powers are the ones most required. Were there more bedding in practiced, we would have more and better-skilled tradesmen. A novice, in traveling through the foundries of the country, would be at a loss to reason why shops, in making similar castings, do not adopt similar methods. He sees one bedding in almost everything. Another he finds rolling over everything In many cases this puzzles even practical men to reasonably explain. One can go into many shops and there see patterns being bedded in that, all points considered, could be better rolled over. Then, again, he will find the reverse, there being large, expensive flasks used for moulds that could be made in less time and with far less risk by being bedded in. There is no doubt that upon this point there are shops that are working in error. Almost every machinery foundry has some jobs that would be better were they bedded in, and some that would be better rolled over.

Sometimes circumstances may be such as to call for a pattern being bedded in when, properly, it should be rolled over. This, however, is no excuse for the wide difference in shop practice.

I have seen practical men who, when questioned why they did not have certain jobs bedded in, would say they knew it was the proper way to mould them, but having so little of that class of work to do they did not like to have their shop floors all dug up. This is, no doubt, in many cases, a good reason for not bedding in work. Shops in which most of the work is bedded in are, as a class, the dirtiest and ugliest to be found. It is practically impossible to keep them as clean and orderly as a shop that does all rolling over. A foreman that loves order hates to see his shop a jumble of holes, sand heaps and foundry tools. He may to some extent control and keep order, but to this there is a limit. It can be carried so far as to be a source of expense rather than of profit. My lot has been chiefly to be employed with the dirty class of shops. It has often made me feel envious of my brother tradesmen who work in the clean shops to think with what comfort they can work; and I would long ago have been one of their number were it not for the charm that bedded in and heavy work has for me. There is a fascination about bedding in that many moulders enjoy, whether because it is so dirty or that it makes them exercise their brains more is for them to say.

The advantage that bedding-in has over rolling over is, in the first place, the saving of flask making; second, the rigidness with which sides and bottoms of moulds can be supported against the strains of high and heavy heads of metal; third, the assurance it presents of making a casting the duplicate of the pattern in shape. The twisting and wrenching that is given large flasks in being turned over often makes it impossible to make a casting as true as its pattern. This point was ably brought out in an article by "Foundryman," in the AMERICAN MACHINIST, of March 10th, 1883, entitled: Moulding a Bevel Wheel.

It is amusing to see how some moulders who have never done bedding-in go about such jobs. Not very long ago a moulder who thought himself a first-class man started to work under my supervision. I gave him a pattern, with instructions to bed it in. He said if he had a flask to roll it over he could make it in half the time. My answer was, that we did not make a practice of making expensive flasks, that could be saved by bedding in; especially so where there was only one or two of a piece to make. He started at the job, and at the end of about two hours he put on his coat, remarking to a moulder, that he was not going to work in a shop where they had to lay upon their bellies to make a mould. The trouble was, he did not know how to bed in, and would willingly have kept that position all day if it would have given him the knowledge which his conceit prevented others from giving him.

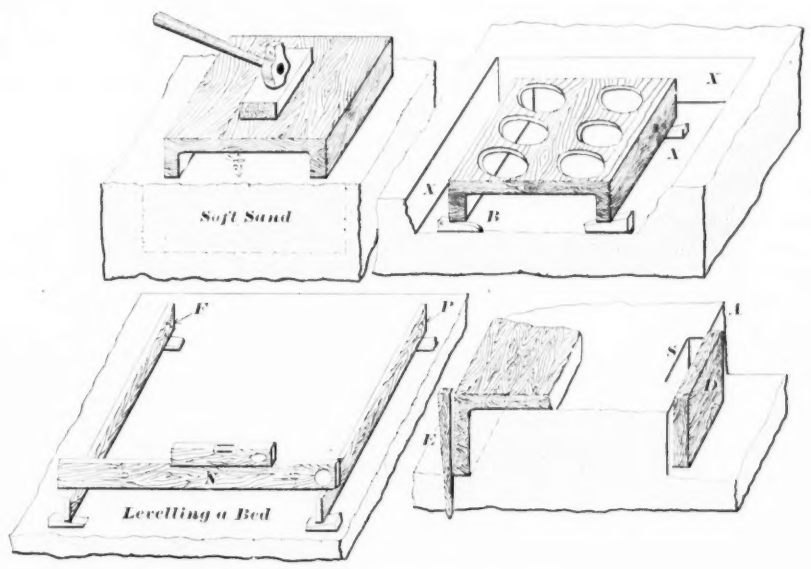
Among moulders who bed in, there are two plans that are often adopted. One is to pound down a pattern, and the other to tuck it up. This pounding down business, I do not approve of. In the first place it causes a mould to be the reverse of what its condition should be (a point which I have previously written upon); in the second place it abuses a pattern, and in the third place, although it may often be a quick process, it is not by any means a mechanical one.

Any bull head can sledge down, but it requires skill to tuck up.

There are a large number of patterns that can be either sledged down or tucked up; the one shown in the sketch being of that class. In sledging down such patterns, the process is, generally, to first dig out a hole and fill it up with sand riddled through the shovel, then sift on about ½″ thickness of facing sand, on top of which set the pattern, and on top of this the block, without any regard to which way the grain of pattern timber runs.

Then sledge down the pattern until about level with the sand bed, that is providing the patterns hold together.

To tuck up such a pattern, the hole is generally dug out about 3″ deeper than the pattern, and the pattern is rested upon four blocks or wedges, as at *B*; or, the four bearings may be sand mounds; with the hand sand is tucked under the pattern, after which the pattern is drawn and the surface of the mould felt all over, and any soft spots found filled up. A thickness of about ¼″ facing sand is then sifted on the bed, and the pattern returned. A sledge is then used to knock it down about ¼″, after which the sides *X X*, are rammed up, the joint scraped off and the pattern sighted to see if it is out of wind. This completes the bedding-in.



BEDDING IN AND ROLLING OVER.

While this in substance is one proper way to bed in, I will dwell upon a few details showing different ways of handling such jobs. Some, in tucking up such jobs, especially if the boss is not looking, will use all facing sand for the inside. Others will use all common heap sand, and when the pattern is drawn they will press facing sand against the sides; and after sifting ½″ thickness, or such a matter, over the surface, the pattern is knocked down to its bed. Some, again, will draw the pattern up to examine if all places are firm and of an even hardness. There is a great difference in the ability of moulders to make a firm bed the first time. Some will have to draw out a pattern three or four times before they can get as firm and reliable tuck as others can obtain by once drawing out.

Before going any farther there are two points which I would call especial attention to. The first is the rapping down of tucked up patterns. Before a pattern is first drawn the guiding stakes should be driven so as to be a guide in showing how much the pattern is to be knocked down. At *E*, the stake is shown driven, having its top even with the top of pattern, there being one of these stakes at each corner. When the pattern is returned it is readily shown how much it should be pounded down. I doubt if one-fourth of the moulders ever make any calculation upon knocking down a pattern. Some of them pound until the pattern will go no farther, and others won't impress it enough. Every piece that is bedded in should have a limit to its impression into the bed, and the moulder should use his judgment as to what that limit is. The majority of moulders can tell by feeling a mould whether it is too hard or too soft. This is certainly an accomplishment, but it would be a better one to know how and when they were making it hard or soft. The second point I would like to call up is shown at *D*. This represents a plan which some moulders have of filling the sides of tucked up moulds—a very good plan too. It is simply cutting out a piece of the side of the mould, and then by means of a board, *D*, running up the cut out place at *S* with facing sand. After this cut out another portion and ram it up, and so on until the whole side is rammed up. This plan for heavy work, where sides or flanges cannot be come at to ram solidly up with facing while the pattern is in place, is a good one to adopt, as it gives a chance to make a firm surface when the pattern is withdrawn. There are many patterns where level beds can be used to assist in bedding in, the plain surfaces of the patterns resting upon the beds, and the irregular parts being tucked up. Wherever a leveled bed can be used, it should be, as there is no way that a mould bottom can be controlled and made so reliable.

Few moulders will make a level bed. In leveling a bed, one side, as *F*, should be first leveled up, after which set the opposite one, *P*. Then upon the top of each and at one end, as seen, set a parallel straight edge (by parallel I mean that it must be *exactly* the same width at each end, not 6″ at one end and 5½″ at the other). The straight edges *F* and *P*, do not require to be parallel, but *N* must be if a level bed is wanted. With the parallel straight edge, level across from *F* to *P*, then try the level on *P*; and if it should not be level, make it so by raising or lowering the end at *P*. Then test the straight edges by going over them all two or three times if necessary. Another point to be watched is the level, which in a foundry soon gets out of truth. The way to test a level is to turn it end for end. If it shows level one way and not another it is out of truth. The only way to use such a level is to turn it end for end, and make the bulb stand the same distance from the center mark each way.

Under the straight edges shown are four wedges, representing what should be sand mounds. The middle portion of the straight edges should be kept clear until they are leveled up, after which tuck under them. Leveling straight edges having a bearing their entire length causes a loss of time and extra labor. The holes seen in the straight edges are to hang them up by, something that is not always done.

The six holes seen in the pattern being bedded in show a provision that ought to be allowed in many patterns to give the moulder a chance to tuck them up. A pattern to be used for rolling over work, and one for bedding in, should seldom be made upon the same plan, although they generally are. A pattern to be bedded in should be well braced, and made of good strong lumber, for the reason that bedded in patterns have to stand more or less sledge pounding, and where they are like a hollow box it is often impossible for the moulder to make the bottom of his mould as solid and reliable as it should be.

Holman's Phoneidoscope.

During a recent visit to the Franklin Institute, Philadelphia, we were greatly pleased with some experiments made by Mr. D. S. Holman, actuary of the institution, with the Phoneidoscope, an instrument of his own invention. It is a combination of magic lantern and microscope. He spread a soap film over a square opening in a copper plate, then put the plate in the phoneidoscope and projected the rays upon a white screen. The display of coloring brought out was magnificent. He afterwards took a rubber tube that was connected with the instrument and sounded various notes through it. Each note produced a combination of curves on the soap film picture that was peculiar to itself. When this experiment had been repeated several times, it became apparent to the observer that the effect of the different

sounds could by this means be photographed.

The instrument is used greatly for microscopic investigation, and throws a brilliant light through the object which facilitates research. Considerable mechanical skill has been expended upon the designing of the instrument, and the workmanship is excellent.

LETTERS FROM PRACTICAL MEN.

Wabble Drill for Bottoming Holes to be Tapped—Manner of Tapping the Holes—Making Small Taps.

Editor American Machinist:

Thinking that it may be inferred from Frank H. Richards' favorable notice of our special tapped holes that the method is an expensive one, I wish to show how the thing may be done in every-day practice without adding appreciably to the cost of the work.

Assume that it is a common steam-chest cover that is to be drilled and tapped for common $\frac{3}{4}''$ studs, or cap screws. Let the cover be clamped to the steam chest, the holes laid out and drilled in the usual way, and all the chips removed from the holes—I would say, by way of parenthesis, that a blow-pipe or a piece of $\frac{1}{4}''$ rubber hose is a great improvement over a spoon for removing chips from drilled holes—then with a tool, which we call a "wabble drill," shown in Fig. 1, run down in the bottom of the holes they are readily chambered out, as shown in Fig. 2. This chambering out allows the taps to work freely, and the square bottom makes a stop for the stud to bottom against, so that if the holes are drilled to a uniform depth the studs, if of the same length, will come fair with the nuts.

The cover being removed and the holes cleaned out, four struts, as shown in Fig. 3, are secured in the cover, and the whole set on the chest, as shown in Fig. 4. This makes a complete tapping jig. Three taps instead of two are used, for the reason that the taper must be so short that when two taps are required to cut so much they are likely to break out the metal. The shanks of the taps are left the full size over the thread, and a crank is used to turn them, in place of a tap wrench.

The time saved by the use of the crank (and when three taps are used the work is so light that a crank is all-sufficient) more than compensates for the time lost in chambering out the holes, so that the extra cost is simply the cost of the "wabble drill," the four struts, and the special taps and crank.

Mr. William Craig, of this city, has just shown me a new departure in the method of making small taps that seems a move in the direction of saving money. It is usual in the works here engaged in making bolts and nuts, to buy blanks for taps, with long shanks swaged down from stock of the size of the tap over the thread. These blanks are turned and threaded, fluted, tempered in the usual way, and when worn too small, or broken, the whole is thrown away. Mr. Craig's plan is to take the old shank, or other stock of the same size, and swage in a new set of flutes, expanding the metal enough to equal the outside diameter; and then, after dressing off the edges, run solid dies over to form the threads, instead of cutting in the lathe. The dies are run on from the back or shank end, which leaves the cutting edges burred over. Filing off the burrs, filing the taps on the point, backing off and tempering completes the work. At first this looks like a crude way; but is it certain that the result—that is the work turned out—is in any way inferior to the work turned out by taps costing twice the money? The perfection of the thread on the tap simply depends on the perfection of the die with which it is made; and in this three or more dies, sufficiently thick and well enough made, will turn out a good thread. The tap may be crooked, and so, too, are many taps of the best make after they are tempered, and with the common tapping machines there are liable to be other crooked

Fig. 3

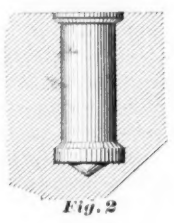


Fig. 2

Fig. 1

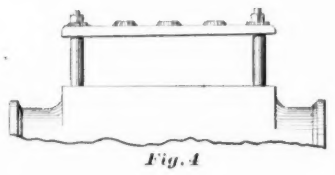


Fig. 4

things that may interfere with the result to as great an extent.

In the works where these taps are used, stove and tire bolts are made, and the result is satisfactory. JOHN E. SWEET.

Drawing Instruments with Sharp Corners.

Editor American Machinist:

Why is it that manufacturers of drawing instruments make them so full of little sharp corners and interior angles? Why not make them of round or oval cross section, with no places where dirt can collect? I like to keep my instruments as bright and clean as when they were new; but, in order to do so, I have to brush and rub them constantly, and I find the little sharp interior angles are the worst places to clean. I buy my instruments for use and not for show, but I must have them clean. Neither can I appreciate the beauty of a set of instruments, ever so finely ornamented, if they are tarnished and covered with dirt. I would like to hear from draughtsmen and instrument-makers on this subject. CRAFTSMAN.

Friction of Gear Wheels.

Editor American Machinist:

On page 9 of the AMERICAN MACHINIST, No. 45, "Draughtsman," of St. Louis, Mo., asks "What is the loss of power in gearing with cast gears?"

Before me are the results of some experiments on turbines, and "the loss of power by transmission through gears," from which it appears that the loss by the use of one pair of bevel wheels, run dry, was from 26 to 28 per cent., and that when "well oiled" the loss was from $3\frac{1}{4}$ to $6\frac{1}{2}$ per cent. When transmitted through one additional pair of spur-wheels, using the same bevels as before and all lubricated with common mill "slush," the loss was from 15 to 19 per cent.

The experimenter says: "As it is a common idea with gear makers that the teeth of the gears *roll* together, so they work just as easy when dry as when well lubricated. The first trial was made with dry gears." There are, nearly always, some missing links, so in this case, it would have been extremely interesting to know the result of the use of two pairs of "dry gears," as also when "well oiled."

Then, again, if the turbine had been tested alone, immediately before and after each gear test, we would have regarded the data as decidedly more reliable, although it is probably a close approximation to the truth.

H. DYNAMICUS.

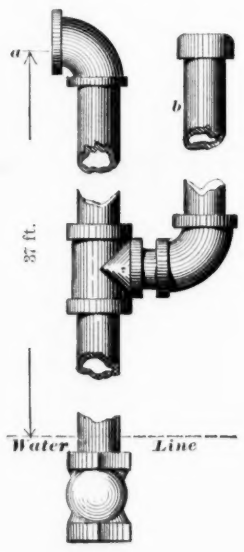
The Grindstone.

Editor American Machinist:

There never was a truer remark made in your columns than that by Frank H. Richards, that "A delicate but sure test of the relative civilization of a shop may be found in the location of the grindstone, and in the condition in which it is kept." How, in the name of common sense, a man is expected to keep a clean-cutting edge on a tool by the use of the average machine-shop grindstone is more than can be told. Before the workman is "judged by his tools," it is in order to judge the management by the condition of the grindstone. Keeping a grindstone in correct order, to properly grind a tool on, isn't one of the lost arts—it never was an art. Nine-tenths of those who look after such things never arrive at a knowledge of the fact that a grindstone lasts longer if it is kept turned true, and that less time is required to keep it in that condition than to keep it half-way so.

Another feature in machine-shop practice is, having only one stone in a large shop, with a half-dozen men waiting for their turn to use it. If plenty of grindstones are provided, with a good iron rest at the front, so that there is some encouragement to grind a tool properly, or at least some possibility of doing it, there will be less tools seen with the points *dubbed* off to all sorts of wrong angles, and the efficiency of the lathe and planer will be wonderfully increased. For doing good work, and a good deal of it, there is more in grinding and setting tools than in anything else.

That Scotch marine shafting lathe, 10-feet swing, published recently in the AMERICAN MACHINIST, has caused considerable comment. The front bearing, 18″x24″ ought to suit the advocates of strong lathes. I. K. C.



Pumping Water Thirty-Seven Feet by Suction.

Editor American Machinist:

In all theory, and in my practice, I have been led to believe that it was impossible to raise water by suction over 28 to 30 feet, and that it was not good practice to pump it over 25 feet. But my attention was called to the fact, that at a certain establishment in this city they were pumping water by suction 37 feet, and, having considerable curiosity, I called to investigate. I inquired for and found the engineer, stated what I had heard, and found him an agreeable, pleasant man to talk to. He stated it as a fact that they were pumping water by suction 37 feet, that is, from the surface of the water to the suction valves of the pump, 37 feet, with but slight variations. I enclose sketch showing the construction, and will try to describe it.

About 25 feet from the bottom end of suction pipe is a tee, with nipple and elbow. From this elbow a pipe, *b*, of the same diameter of the suction pipe, extends to the same height, and is covered with a cap. The pump is connected to suction at *a*. There is a check valve at the bottom end of suction pipe; the explanation is: fill both pipes with water, then screw the cap air tight on the top of what I should call the stand pipe *b*. The action of the pump will suck the water out of the stand pipe, and form a vacuum in it that will sustain the water in the suction pipe, so that the pump will lift the water the 37 feet without any trouble.

Now if this can be done, why not raise water by suction, one hundred feet or more, by connecting in a series of stand pipes about 25 feet apart, and leading them all to the same height? Having very serious doubts about it, I would like to hear what some of your numerous correspondents may have to say on the subject. DAVID P. STEWART.

Buffalo, N. Y.

Compound Engines not new on the Mississippi.

Editor American Machinist:

In a paragraph in a recent issue, you mention a new boat on the Upper Mississippi as having compound engines, the first used on the Western waters. Ibeg leave to suggest that your source of information is incorrect. A number of boats now running have compound engines, called "Hartupee engines," after the builder in Pittsburgh. Perhaps the largest of this class now is the J. B. Williams, a towboat—a stern wheeler. The Great Republic, built in 1867, had the same kind of engines, and very powerful; the high pressure cylinders (2) were, I believe, 36 in., the low pressure do. 60 in. by 10 ft. stroke. A boat ran on the Ohio River in 1849, called the Clipper, having compound engines called "Clipper engines," from the name of the boat. This boat was not considered a success. C. W. CRAWFORD.

Brazil, Ind.

Coroner—"And you say that the boiler, when you inspected it, was perfectly safe?"

City Boiler Inspector—"Yes, sir."

Coroner—"And you signed the certificate accordingly?"

Inspector—"Yes, sir."

Coroner—"Did you personally inspect that boiler?"

Inspector—"Great heavens! what are you thinking of? Do you suppose I can risk my life fooling about boilers? No, sir; I do all my inspecting at my own office."—*Troy Standard.*

Notwithstanding there is demand in Texas for mechanics of all kinds in all the booming towns of the State, but few come. In the north they are bound for Dakota and other cold localities. Texas wants men of all trades.—*Dallas Intelligencer.*

A few weeks ago we gave particulars of a fireless locomotive, where caustic soda was used for conserving the heat and returning it to the boiler. The inventor of that process, M. Honigmann, has recently patented in this country a method of utilizing exhaust steam by means of caustic soda. The caustic soda is placed in contact with the boiler sheets. When the exhaust steam passes into the soda, the temperature rises very high, and is imparted to the water inside the boiler. This may prove a good means of saving heat if the boiler plates do not get destroyed by the caustic soda.

Business in the Baldwin Locomotive Works.

The Baldwin Locomotive Works are building six compound steam motors for South Australia, similar to the motor described in the AMERICAN MACHINIST, August 25th. They have also partly finished a group of very heavy consolidation engines for the Denver and Rio Grande Railway. Several consolidation engines for the New York, West Shore & Buffalo Railway are in the erecting shop, also three or four Philadelphia & Reading engines with the Wootten fire box. Some engines for an Eastern road are placed unusually high in the frames, with the object of increasing the depth of fire box. The top of the cylinder saddle is two feet above the center of the cylinders. In looking round this shop we noted an increasing practice of sloping the frames down behind the forward driving box, to give the fire box increased depth. This is in the cases where the fire box rests on top of the frames. There is nothing out of the usual line of locomotive

building going on in the Baldwin Works at present. They are quite busy, and the look-out for work is considered satisfactory.

Sweet's Measuring Machine.

We present with this a complete engraving of this machine, some of the details of which we published last year, not, however, for the purpose of illustrating the instrument. The tool as here shown is designed for common use in the machine shop, measuring from 0 up to 4″, thus adapting it to a large range of work. Its most convenient location is mounted in a block, on the bench, or upon a special stand or table. From this it can, when desired, be removed and used as a caliper for work in the lathe or on the planer.

One of the features peculiar to this instrument is the ratchet threaded measuring screw. The thread of this screw has one square or right angle side, the other side being inclined and the top flat. The nut is cut away so that the top of the thread on the screw does not come in contact with it, and the bottom of the thread on the screw is similarly removed so that the tops of the thread in the nut are out of contact. The threads are further undercut at the bottom, so that after wear, and taking up, the bearing will still be the same, and fair over the entire surfaces. The square side of the thread is the one that controls the measurements; hence a slight looseness, from neglect to adjust the split nut, will not affect its truth.

Another feature is making the screw and nut of equal length. This provides for equal wear the entire length of both screw and nut; consequently they should never be less accurate than when first made. The screw has a pitch of $\frac{1}{16}$ so as to be moved quickly, and does not alone measure distances greater than one inch. For measurements greater than one inch the tail piece is adjusted to distance pieces, of which there are three, 1, 2, and 3 inches in length, respectively, and the screw then used to measure fractions of the next inch.

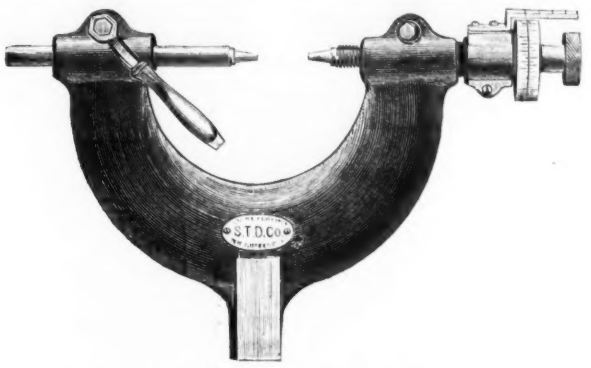
The index is graduated on one side to $\frac{1}{2000}$ inch, and on the other to $\frac{1}{2048}$ inch, or $\frac{1}{64}$ of $\frac{1}{32}$, giving a choice of readings to the user.

The screw is provided with a friction cap, so that in adjusting and measuring equal pressure will always be had on the contact points. Each measuring bar is adjusted to its own screw, so as to correct any errors of pitch, and proving and adjusting are easily and quickly accomplished.

The tool is solid and substantial, being made for everyday use, and would seem to be a valuable acquisition to the machine shop. It is manufactured by the Syracuse Twist Drill Company, Syracuse, N. Y.

Finishing Work by Grinding.

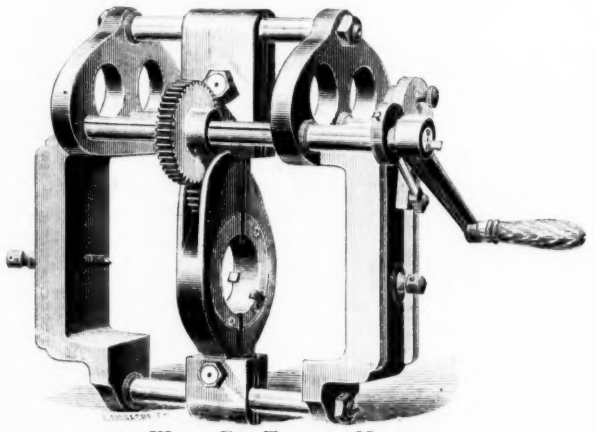
Several parties have inquired of us for particulars regarding the methods practised in the Grant Locomotive Works of finishing rods, guides, links, etc., by means of the emery wheel. We referred to the process two or three months ago, and it has attracted considerable attention. The emery wheels used for this purpose are mounted on an oblong frame, whose upper end is attached to a power-shaft close to the roof of the shop. A belt reaches from a pulley at the top of the frame, and operates the emery wheel shaft at the bottom, which is about three feet from the floor, and convenient for the workman to handle. Two emery wheels are put on the revolving shaft—a large one for ordinary plane surfaces, and a small wheel for curved parts, such as the backs of expansion links. The work to be ground is placed on a movable bench, and the swinging frame enables the workman to pass the rapidly-revolving emery wheel over the work. The distance between the point of suspension of the frame and the emery wheels is about nine feet, so the wheel can be oscillated over a long arc. Much of the success of the operation depends upon the skill of the workman, but the work is said to be easily learned. No filing is needed to finish articles that pass through this process, but it is only adapted for work that does not require to be absolutely true. For the face of guides and other surfaces requiring accuracy, an emery wheel on a flat metal table is used. In every trip we make round machine shops we meet with new and extended use for the emery wheel, the milling machine, and the flexible shaft.



SWEET'S MEASURING MACHINE.

Portable Wrist Pin Turning Machine.

Any one with experience in that direction will readily admit that turning, by the ordinary method, the wrist pins in cross-heads of the locomotive type, where the pins are cast or forged solid with the cross-head, is both laborious and expensive. It is as well known that such pins will wear out of round, and that much time is expended in getting them into an unsatisfactory shape by the use of a file. The machine illustrated herewith is one made at the Flanders Machine Works, 1025 Hamilton Street, Philadelphia, Pa., and is designed for expeditiously turning new pins or truing up old ones. It consists of two pieces, held together by parallel rods, that serve as guides for turning.



WRIST PIN TURNING MACHINE.

The cutter head, carrying two cutters, is driven by gearing from the shaft to which the handle is attached. This shaft is splined between the two sides of the frame, and revolves the driving gear which slides along the feather as the cutter head is advanced. The cutter head has teeth on its periphery, and is driven through an intermediate gear, which gears with the driving gear and with the teeth on the cutter head.

The traversing parts, with the cutter head are divided for the purpose of placing them over the pin, the sections being held together by tapered bolts. The cross-head is centered against the pin, and held in position by the center-pointed bolts in the sides of the frame, exactly as between the centers of a lathe. The cutter head is fed along by means of a feed screw which is operated automatically, the tools being so arranged that the pin is turned from end to end.

A Scotch Echo from the Galleries.

"Man alive, Chordal, bit yer a guid yin. Ye strak the nail cleen on the heed whan ye gae us that racket on ma auld freen, Hughoc Cooan. Come, gie's your han'; what wul ye hae?

"D'ye ken, man, Hughoc an' me wur printice laddies thegither, an' I wis aye kin' o' tidy, ye see, an' Hughoc what dis he dae but gaes borrowin' ma tools a' the time. Deil a tool wad bide in ma box; they war aye awa' roon Hughoc's lay. An' sic a jim-jam roon his lay, a'thing throu'ither, an' a nook for naething. I widna stan' the mislear'd drants o' the mensless loon ony langer. So I jist herriet him o' ma belangins, an' tald him to gae doytin along wi' his ain graith, sin' he wis sae wasterfa o' what didna belang tae himsel'. Dae ye ken, Chordal, it had a fine effeck? Oh, man, bit it had. Frae that day he trig'd up wonderfu', and didna keep hauf o' the auld litter roon. Nae mair jaukin aboot his wark; nae mair smoutie tools wi' Hughoc. He was a cheenged loon.

"It was gie like him to gae off that gait withoot sayin' a wurd, an' fin' out what ithers war daein an' syne stick oot that bit notice. Ha! ha! It gars me lauch, I ken Hughoc's blait way sae weel.

"Say, Chordal, man, ae wurd. Dae ye ken, this tool-room clatter is an unca guid thing. It's makin' mony tool-rooms. I hae a gleg auld farran clerk in ma office, an' he has feegured oot that ma tool-room, an' it is bit a puir ane, is coinin' money for us. An' I startit it in muckle the same fashion as Hughoc did his.

"Rauchle us up wi' yer glib gabbit fire, Cordial; keep yer tinkler jaw lowse, for we a' need it bad, an' it maks us try tae change; yer words inspire us wi' thoughts meet for repentance." JOCK.

How to Copy Drawings by the Blue Process.

We have had many inquiries about using the blue-print process for copying tracings. In many drawing-rooms the prints produced by this process are not clear and distinct. Most of them that we have seen have been below the proper standard; yet there is no difficulty in making strong, sharply-defined blue prints by using good paper and a correct method.

Keuffel & Esser, 127 Fulton Street, New York, who supply a particular kind of heliographic paper, which gives very satisfactory results, have published a circular giving their customers specific directions for copying tracings. By their permission we reproduce that portion of the circular:

The manipulations required are of the simplest possible kind, and are entirely within the skill and comprehension of any office-boy who can be trusted to copy a letter in an ordinary press. These particulars are as follows:

1. Provide a flat board as large as the tracing which is to be copied, or better, a photographic frame specially made for the purpose.

2. Lay on this board two or three thicknesses of common blanket, or its equivalent, to give a slightly yielding backing for the paper.

3. Lay on the blanket the prepared paper with the sensitive side uppermost.

4. Lay on this paper the tracing, smoothing it out as perfectly as possible, so as to insure a perfect contact with the paper.

5. Lay on the tracing a plate of clear glass, which should be heavy enough to press the tracing close down upon the paper. Ordinary plate glass of three-eighth thickness is quite sufficient.

6. Expose the whole to a clear sunlight by pushing it out on a shelf from an ordinary window, or in any other convenient way, for six to ten minutes. If a clear skylight only can be had, the exposure must be continued for thirty or forty-five minutes, and under a cloudy sky sixty to ninety minutes may be needed.

7. Remove the prepared paper and drench it freely for ten minutes or longer in clear water, and hang it up by one corner to dry.

The paper should be stored in a dry place, and be entirely shielded from the sunlight before being used.

The paper is of a full yellow or bronze color. After the exposure to the light the surface becomes a darker bronze or yellowish gray, and the lines of the tracing appear as still darker on the surface. Upon washing the paper, the characteristic blue tints appear with the lines of the tracing in vivid contrast.

Such copies can be taken from tracings only, either made on tracing paper or cloth. A very deep black India ink should be used, as the distinctness of the copies depends thereon.

Work in William Cramp & Son's Ship-yard.

On Saturday last William Cramp & Sons, Philadelphia, launched a fine iron steamship called the San Pablo for the Central Pacific Railroad Company. The hull is 338 feet long, 42 feet beam, and 29½ feet depth of hold. The engine for this vessel is set up in the machine shop connected with the yard. It is of the compound vertical inverted type, with two cylinders 42 and 78 inches diameter respectively, and a stroke of 51 inches. Steam will be supplied to the engine by four steel cylindrical return tubular boilers 14 feet diameter and 12½ feet long. Each boiler has three cylindrical furnaces 48 inches diameter. The steel sheets are $\frac{18}{16}$″ thick. The longitudinal seams of the boiler are double welt riveted, and the circumferential joints are double lap riveted. The working steam pressure will be 85 pounds to the square inch. The propeller of the San Pablo is 16 feet diameter.

Another vessel being built in the same yard for the Metropolitan Steamship Line is 270 feet long, 41½ feet beam, and 29 feet depth of hold. The engine for this vessel is similar to that of the San Pablo. The engine has a variable cut off on the high pressure cylinder with a right and left hand screw adjustment that is worked from the engineer's platform. Wheelock packing is used for the high pressure cylinder, and a single ring held out with spiral or *z* springs will be adopted for the low-pressure cylinder. An independent circulating pump of the Gwynne type is used. The boilers are similar to those already described. All the steamboat boilers that this firm is now making are of steel, and the holes are all drilled. They are building a special tool for use in accelerating the work of drilling boiler plates. At present portable drills are used to a great extent, but the new tool will take their place.

The firm has also on the stocks three iron ships for the Southern Development Company. Their dimensions are 330x4x22 feet. These boats will have tandem compound engines, with cylinders 38 and 76 inches diameter, and 54 inches stroke. They will have 4 cylindrical return tubular boilers, giving a heating surface of 8,700 square feet. Propeller 17 feet diameter.

Besides their marine work the company is building a compound engine 400 horse-power for a textile establishment in Germantown, Pa.

Jay Gould's yacht Atalanta is in the yard being lengthened 16 feet. The engine and boilers are being rearranged and the propeller shaft will be lengthened to suit the changes.

In all the engine work done here, steel is used for piston rods, valve stems and crank pins. The main rods of the heavy engines are built up on a plan recommended by Mr. See, the superintendent, in a paper read before the Society of Mechanical Engineers last year.

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NEW YORK, DECEMBER 8, 1883.

CONTENTS.

PAGE

New York, West Shore and Buffalo Railway Standard Locomotive 1-2
The Improved Thompson Indicator 2
Objections to Inside-Connected Locomotives 2
Death of a Celebrated Metallurgical Engineer 2-3
The Milling Machine—It Construction and Uses. By John J. Grant 3
Meeting of the New York Car Builders' Club 3
Work in Locomotive Shops at Paterson 3
Good Quality of American Shipbuilding Iron 3
New Use for the Westinghouse Air Pumps 3
Growth of the Train Brake. By Angus Sinclair. 4
Reduction of Force on the Northern Pacific Railroad 4-5
Bedding In and Rolling Over. By Thomas D. West 5
Holman's Phoneidoscope 5-6
Letters From Practical Men.—Wabble Drill for Bottoming Holes to be Tapped; Manner of Tapping the Holes; Making Small Taps—Drawing Instruments with Sharp Corners—Friction of Gear Wheels—The Grindstone—Pumping Water Thirty-seven Feet by Suction—Compound Engines not New on the Mississippi .. 6
Business in the Baldwin Locomotive Works 6-7
Sweet's Measuring Machine 7
Finished Work by Grinding 7
Portable Wrist Pin Turning Machine 7
A Scotch Echo from the Galleries 7
How to Copy Drawings by the Blue Process 7
Work in William Cramp & Son's Shipyard 7
The Iron Trade and General Industry 8
Defenders of our Weights and Measures 8
Questions and Answers 8
Business Specials 9
Manufactures 9
Machinists' Supplies and Iron 10

The Iron Trade and General Industry.

Several of the best known daily newspapers, included within the charmed circle of that old fossil organization known as the "Associated Press," have lately been laboring, with a zeal they seldom show in regard to industrial matters, trying to convince their readers that the iron trade is in a critical state of depression. Nothing has happened within the last few weeks to warrant any such extraneous view. The iron trade has been dull for more than a year; and, while there are no signs of an early return to complete activity, the situation is not as bad as has been represented by the daily press. It was shown by reports recently published by Mr. Swank, secretary of the American Iron and Steel Association, that the whole stock of pig iron on hand and unsold on the first of November was much less than on the first of July last. Consumers have bought sparingly only to supply immediate requirements, and therefore may be relied upon to keep purchasing without holding back for long intervals. With no accumulation of stocks at the furnaces, it is unlikely that prices of pig iron will decline very seriously. The recent decision of the Western Nail Association to close all their mills, for the five weeks from December 22d to February 4, has been commented upon as showing great depression. It is really a concerted effort to bull the nail market, rather than any evidence of a bad condition of trade. If the nail manufacturing business were reduced to an unprofitable basis, we should not hear of so many new nail mills being erected, as we have during the last few weeks.

The future of the iron trade, as well as each of the other trades, depends upon the general industrial activity of the country. Perhaps the best indicator of the latter is found in railroad traffic and earnings. Earnings for the month of October, this year, of sixty-eight railroads (all that publicly reported their earnings), which together worked about half the railroad mileage of the country, were over ten per cent. greater, than for the same month last year. These roads increased the length of their tracks during the year over nine per cent., yet the earnings per mile were greater than last year by one per cent. This compilation, which was made by the *Railroad Gazette*, gives a better idea of the real industrial gain of the country than whole volumes of speculation upon the condition of any one trade.

The profits of productive industry are generally smaller than they have been, and speculation is not as rife as it was two years ago, but there are no signs of a collapse of general business.

Defenders of Our Weights and Measures.

There have been so many associations, great and small, formed in this country for the suppression of our established system of weights and measures, and they have expended so much abuse upon Anglo-Saxon methods of weighing and measuring, that a great many people have been deceived into the belief that our metrology is the worst in the world. The crusade against our system of weights and measures got a bad repulse in the report which Mr. Coleman Sellers prepared for the Franklin Institute, in 1876, on the metric system, and again in a paper read at the meeting of mechanical engineers in New York in 1880. Of late the friends and advocates of the metric system have been rallying their disorganized forces, and agitation in favor of enforcing their system is again heard at industrial and scientific meetings. The indications are that the talk is not going to be any longer confined to the enemies of our established system. Societies are being organized all over the country for preserving the Anglo-Saxon weights and measures. At a meeting of a society of this kind, recently organized in New York, a speaker quoted figures to prove that nearly one-half the total wealth of the world was possessed by nations using the weights and measures in use among us. He also went on to prove that nations using our system carry half the tonnage of the world; that two-thirds of the commerce of the world is in their hands, and their trade is increasing in a ratio three times greater than that of other nations.

We are indebted to David Eckstein, United States Consul at Amsterdam, for a programme of the International Agricultural Exhibition of the United Netherlands Agricultural Association, to be held at Amsterdam, commencing August 25th, and closing September 6th, 1884. Any one disposed can enter exhibits by applying to the secretary of the executive committee, P. F. L. Waldeck, Loosduinen, near the Hague, who will furnish the necessary blanks. These must be filled and returned before the first of April. In the department of agricultural machinery the exhibits must be in position and in working order by the morning of August 21. Materials required for testing this machinery will be furnished free of charge, but the motive power necessary must be furnished by the exhibiters. The printed list contains about all the machinery that can in any sense be classed as agricultural. The prizes in this department consist of medals, gold, silver and bronze.

A railroad master mechanic, in a letter just received, inclosing a number of subscriptions to the AMERICAN MACHINIST, says:

"These are all mechanics. I hope, next year, that this good seed may fall amongst the apprentices in our shop. They all say now, that they cannot afford it. I notice some of them can afford story papers, which are doing a great deal of harm and no good. To young men, who are full of ambition and hope, this terrible affliction of story papers is doing more injury to their vigorous and impressible minds than they can ever dream, until they have lost the golden opportunity for self-improvement, and have acquired a vicious taste, which rides them like an incubus and holds them down for life."

The kind of stories that appear in the most widely-circulated papers of that class have just the effect pointed out above. A young man who habitually reads these extraneous yarns has but a limited portion of his mental capacity to devote to the realities of every-day work, and lets others, in the same occupation, whose minds are not crammed with the scum of some cheap writer's imagination, get ahead of him. Not all works of fiction are pernicious, however. It won't hurt apprentices (or anybody else) to read the works of Dickens, Scott, or Cooper. Such stories will not spoil their interest in good mechanical literature, nor weaken their ambition to advance themselves in their business. Still, the greater portion of reading should be of fact rather than fiction.

The small degree of practical knowledge possessed by some parties who get out inventions for practical work is well illustrated by a late patent granted for a signaling device for railroad crossings. By a wire connection an approaching locomotive is made to raise a flag at the crossing. Movement is given to the signaling apparatus by a horizontal rod sticking out about two feet from the pilot of the locomotive. In practical railroading a locomotive would not run ten miles before this bar would be broken off.

When one orders sugar from the grocery store it is not always necessary to order even pounds. So many dollars' worth is usually a more convenient quantity.

So in sending subscriptions to the AMERICAN MACHINIST, it is not necessary to send the price of one year's subscription, viz., $2.50, unless equally convenient. We receive many subscriptions from parties who simply inclose bills to the amount of $1 to $5, in a letter, and the amount sent is duly credited up, to cover the amount thereby paid for.

In the grocery instance, it is simply a question of so much money, so much sugar. In the other case, it is so much money, so much paper.

To persons who are desirous of remitting just enough money to cover one year's subscription, and cannot conveniently remit $2.50, we can suggest a very good plan indeed, as a substitute, and that is to interest some friend in the paper, and induce him to join in as a subscriber. Then a $5 bill will just pay for both.

The New York daily newspapers have always been ready upon occasion to accord their valuable advice upon the best course for both manufacturers and workmen to pursue in case of a strike. They have pointed out conclusively (to themselves) just how strikes can be overcome and prevented. A week or two ago the compositors in many of the New York newspaper offices struck for higher pay. Did the publishers take down their files of back numbers and read their own editorials upon just such emergencies, showing just how to act, by way of refreshing their memories? Not a bit of it. They were seized with a panic, and, with one or two exceptions, came down flatly to the compositors' demands, in from thirty to ninety minutes. Somehow there is a dearth of essays upon strikes, during the last few days, in the columns of the metropolitan "leading" dailies.

Many of the best engineers in Western river cities have been striving for years to combat drinking habits, which make many victims among steamboat men. The peculiar life they lead, away a great part of the time from home influences, has made these men singularly subject to the temptations of the flowing bowl. And there was every means of encouraging inclinations in this direction. Drinking bars were as firmly established in river boats as was the steam engine, and by a certain class they were considered quite as requisite. A quick revolution is now going on that promises to change matters in this respect. Some of the best firms running boats on the Ohio and Mississippi rivers have abolished the bars, and they are getting the best of the passenger-carrying trade in consequence of this change. As the practice pays, it is likely to be further extended. But the service will benefit by the change, and a sore source of temptation to employes will be taken away.

The price of the AMERICAN MACHINIST was reduced, beginning with issue of Nov. 3, to five cents a copy, or $2.50 a year. Readers who do not find copies for sale by newsdealers in any part of the United States or Canada where they have asked for this paper, will confer a favor by dropping us a line about it.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(380) J. T., Vail, Iowa, writes: We have a 13″x20″ engine running 114 revolutions per minute, and about half loaded. Which would be the better: to reduce the speed to 80 revolutions per minute, or to put a cut-off on the back of main valve? *A.*—The cut-off will give the best economy in fuel.

(381) S. R. J., Pine Bluff, Ark., writes: I am an apprentice, having worked one year. In the shop where I am working they are making a set of cone pulleys of three steps each. The steps on the largest pulley are 12″, 12½″ and 13″. On the smallest cone the diameters are 3″, 3½″ and 4″. I claim that the belt will not be equally tight on all the changes. Am I right? *A.*—You are right.

(382) G. L., New York City, asks: Can you tell me how to determine how much to set over the tail stock of a lathe to turn a given taper? *A.*—Multiply the length of the piece in inches you are turning the taper on by one-half the taper per inch. For example: suppose you want to turn a taper of ⅛″ to the inch on a piece 11″ long. One half of ⅛″ is 1-16″ and 11 multiplied by 1-16 equals 11-16, hence you should set over tail stock 11-16″.

(383) W. M., Brooklyn, N. Y., sends sketch of arrangement for pipes for heating by exhaust steam, and asks: Will I be able to use it without excessive back pressure on engine? *A.*—We should say you must have some way, not represented, of keeping the pipes free from water. A

cheap water tap below the elbow where the 3″ pipe joins the 2″ inlet, we should say would make it all right. It will work with about two or three pounds back pressure, and prove economical.

(384) R., Freeport, Ill., writes: In using steam for heating, is it the proper way to have the valve at boiler wide open and regulate the circulation at the drip, or leave the drip wide open and regulate at the boiler? *A.*—If you return the drip to the boiler, the circulation will take care of itself. If not, you will have to regulate the drip cocks the best you can. In any case you should regulate the heat by the valves at the radiators, or at the boiler if there are no valves at radiators. If boiler pressure is too high, use a pressure regulator.

(385) Y. H., Philadelphia, Pa., writes: I have an old engine to repair. The engine is 10¼″x20″, and runs 90 revolutions per minute. The steam ports are ¾″x5″; bridges ⅞″; exhaust port 2″. The valve has 11-16″ outside lap, and no inside lap; travel 3″. The clearance in cylinder is ⅛″. What I want to know is, if it would not be better in making a new valve, to give some inside lap, to prevent so early release? *A.*—The average release (between the two ends) will now be about 18½″, and exhaust closure the same. By adding 3-16″ (on a side) inside lap, the release will take place at a little more than 19″, and the exhaust closure at about 18″. This should help a little in the way of smooth running, but owing to the small ports, will not probably improve the economy of steam consumption.

(386) H. N. S., Gouverneur, N. Y., asks: 1. Does the pressure of the atmosphere on the outside of a boiler make it capable of withstanding more steam pressure than if there were no outside pressure; and if so, why? *A.*—The pressure of the air on the outside of the boiler is equal to, say, 14 7-10 lbs. per square inch, consequently it balances the same pressure on the inside. If the air were exhausted from the boiler, the tendency of the external air would be to collapse the boiler. The ordinary steam gauge does not register pressure below the pressure of the atmosphere, so that if the gauge shows 10 lbs. pressure there is really a pressure of 10x14 7-10=24 7-10 lbs. Only 10 lbs is resisted by the boiler, but if it were not for the pressure of the atmosphere on the outside, the boiler must resist the total 24 7 10 lbs. 2. How much power will a 10 foot rosette wind mill give on the average? *A.*—Probably about 1-10 of a horse-power.

(387) G. W., Boston, Mass. From a shaft making 30 revolutions per minute, I wish to get a movement of 2″ of a lever at right angles to shaft, said movement to occupy but one-twelfth of a revolution of the shaft. I have room for only an 8″ cam, and cannot devise one that will work on so small a part of the revolution. I could put up another shaft to run, say, three times as fast, and then get one-fourth of a revolution for the cam to work in; but no simple plan presents itself by which to prevent the operation of the cam, except for every third revolution. Can you suggest anything? *A.*—A plan that suggests itself, without knowing more of the arrangement, is to get the motion from the long end of the lever, the cam, on the first shaft, working on the short end. With an 8″ cam you will have a little more than 2″ of the circumference in which to work, and by making the ends of the lever three or four to one, we should think you could accomplish your purpose.

(388) J. B. W., New Brunswick, N. Y., writes: I am running two 10″x12″ engines, and am troubled with hot crank pins. The engines pound very bad, and if I key them up they heat. Had I better work with the brasses loose, till they come to a bearing, with oil or water? Can a crank pin be broken by pounding, and what other damage does pounding do? What is the best lubricant for hot journals? *A.*—You had better first ascertain if your engines are in line; then examine the brasses and see if they do not require scraping to fit the pins. If they bear hard at the edges, they should be relieved. If there is no objection to water you can use it occasionally. Start with the brasses a trifle loose, and key up gradually. Lard oil is a good lubricant. Sometimes sulphur will be of service in cooling a hot bearing; sometimes black lead will assist. The main thing, however, is to get a good bearing surface and the parts in line. Excessive pounding will tend to break the pin, and otherwise to derange the engine.

(389) A. A., Killisnor, Alaska, asks: How can I re-babbitt worn out boxes, and will it be necessary to remove the old babbitt from the lower half of the box? In this case, this is a little difficult to do. *A.*—We cannot tell just how you should proceed, without particulars. You should remove the old babbitt from both parts of the boxes, then line up the shaft so that it will leave room for the babbitt to run. If you cannot conveniently come at the box for scraping after pouring the babbitt, wrap a piece of paper—letter paper, or heavier paper if the shaft is large—smoothly around the shaft, and secure it by winding a fine thread three or four times around. It is better to warm the box and shaft, which may be done by laying hot irons around them. Stop up any holes out of which the babbitt will run by putty or fire clay. Melt and heat the babbitt slowly until it will just set fire to a clean piece of a pine board. Just before pouring it is a good plan to drop two or three small pieces of resin on the melted metal. In babbitting the cap, place it on the box with some strips of sheet metal over the babbitt in the box, so the two will not "weld" together.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Match Machinery, F. Chillingworth, New Haven, Ct.

F. VanWinkle, Mech. Engin'r, 22 Cortlandt St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Metal & Wood Patterns—G. D. Lambert, N. Haven, Ct.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

"Tack Machinery"
Willets Manufacturing Co., Providence, R. I.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh Wells, & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 144 LaSalle st., Chicago, Ill

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

New Books, relating to steam, the steam engine, mechanics, machinery, and engineering. Send for catalogue. Fred. Keppy, publisher. Bridgeport, Conn.

The "Wax Process" engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Jack pump and ladder chain machines, 40 to 80 links per minute, direct from coil. The Gaylord, Cross & Speirs Company, Waterbury, Conn.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Slide Valve Working Models. Send for circular. See notice in this paper, October 13, page 9. E. E. Roberts, 107 Liberty Street, N. Y.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Corliss Steam Engines at a bargain. One 12″x42″; one 16″x36″; one 20″x42″. All in first-class running order. Henry I. Snell, 135 N. 3d Street, Philadelphia, Pa.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880. A limited number for sale at $3.50 per volume, express charges to be paid by purchaser. $4.50 per volume will be charged for 1881 and 1882. AMERICAN MACH. Pub. Co., 96 Fulton st., New York.

"HOW TO KEEP BOILERS CLEAN."—A book of seventy-two pages, telling how to prevent scaling, foaming, priming, and burning, with other valuable information, will be sent to any address FREE of postage, by James F. Hotchkiss, 86 John street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. AMERICAN MACHINIST PUBLISHING COMPANY, 96 Fulton street, New York.

Patent "Common Sense" Binder for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address, in the United States, by mail for one dollar. To Canada and foreign countries 75c., the purchaser to pay custom-house duties and express charges. American Machinist Publishing Co., 96 Fulton street, New York.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

MANUFACTURES.

Fort Worth, Texas, is talking of a $1,000,000 cotton mill.

Pittsburgh iron mills are generally dull. Orders are very slack.

The Sessions Foundry Company, Bristol, Conn., have built an addition 70x80 feet.

During the year 100 new locomotives have been built at the Altoona, Pa. shops and 250 repaired.

The Holyoke Machine Company, Worcester, Mass., are building a 167x64 foot addition, three stories high.

The Novelty Iron Works of Oskaloosa, Iowa, are adding to their capacity to build steam engines and machinery.

The Catasauqua (Pa.) Manufacturing Company has made a reduction of ten per cent. upon the wages of all employes.

Truxall & Dunmeyer, Chattanooga, Tenn., have been delayed in building their new machine shop by a dispute over the title of the site.

The State of Louisiana exempts new manufactories from taxation for ten years.

Ames & Frost will build an $8,000 factory at 213 Cherry Avenue, Chicago.

The new foundry to be built by the Reading (Pa.) Hardware Company will cost $10,000.

The Philadelphia & Reading Coal & Iron Company will erect, at Reading, Pa., one machine shop to cost $25,000, and another to cost $13,000.

The new round house of the St. Louis & San Francisco Railroad, to be erected on Chouteau Ave., St. Louis, will cost $15,000.

The Cobb Spring-Tooth Harrow Company has accepted an invitation, accompanied by a liberal offer, to establish their works at Sturgis, Mich.

Subscription books have been opened in Louisville for raising the capital to establish a 15,000-spindle cotton mill. The prospect is reported favorable.

The Chippewa Lumber & Boom Company, of Chippewa Falls, Wis., will this winter expend $50,000 on its planing mill and lumber yard.

Black River Falls, Wis., is agitating the question of erecting a blast furnace to utilize its iron ore. St. Paul capitalists are interesting themselves in the matter.

A new woolen mill is being built near Cartersville, Ga., that is reported to cost $100,000, to be run by water, though without a dam, the natural fall being utilized.

The new machine shops of the Bullard Repeating Arms Company, Springfield, Mass., will be 169x40 feet, four stories high. Power will be furnished by a 100 horse-power engine.

Jewelry making is the big business of Providence, R. I. There are 184 manufacturing establishments, employing about 3,500 hands, and turning out $5,775,975 worth of goods annually.

Calvin Carr, Geo. A. Ohl and others have organized the Calvin Carr Cornice Machine Company at Newark, N. J., for the manufacture of cornice machinery, engine lathes and other articles.

The Washburn Iron Company, Worcester, Mass., will put in machinery to make steel rails and structural steel work. The plant will be in full operation about the middle of April.

The Cambria Iron Company, Johnstown, Pa., has provided an ambulance fitted with every known appliance for the benefit of those injured in their employ, who average about one a day.

F. B. Trahern, Rockford, Ill., writes us that he has just completed a substantial three-story brick building, to be used for the manufacture of brass goods and brass castings of every variety.

The Brazelle Manufacturing Company, St. Louis, have started up a machine shop on North Second Street, for the manufacture of small specialties, among which will be a steam pump of a new design.

The Union Rolling-Mill Company, of Cleveland, O., have just built three new puddling furnaces as an addition to the Etna Mill. This does not look as though that company expects any great decline in the demand for iron and steel.

H. S. Brown, late master mechanic of the Cummer Engine Company, has become manager of the Philadelphia branch of that company. He has taken an order from the Underground Electric Light & Power Co., for engines of 300 horse-power.

It is said that Jay Cooke has purchased a license from Jacob Reese, to manufacture rails by the latter's process, and is about instituting legal measures against the Pennsylvania Steel Company at Harrisburg, for an alleged infringement of patent.

The Standard Manufacturing Company, of Fort Wayne, Ind., has about completed its new shops, which will have a capacity of 30 tons of its standard brake shoes and heads per day. The shop is constructed with a view of at any time doubling this capacity.

The Tennessee Cotton Mills at North Nashville have just declared a dividend on their stock of 14 per cent. Besides this, 6 per cent. has been paid on a bonded debt of $250,000, which would bring the real profits up to about 18 per cent. on $500,000, the total capital.

Mr. E. Patric, of Rochester, N. Y., inventor of a new variable speed grain drill, has organized a new company in this city, with ample capital, which company has purchased the factory, machinery and raw material of the Thomas, Ludlow & Rogers Co.—*Springfield* (O.) *Republic.*

The Railway Speed Recorder Company, Kent, O., has recently completed an addition to its works, which are very busy filling orders for the New York, Lake Erie & Western, the Delaware, Lackawanna & Western, the St. Paul, Minneapolis & Manitoba, and other roads.

A party of capitalists from Peru, Ind., have decided to establish a jute factory at Memphis, Tenn., without delay. The sum of $150,000 will be expended in buildings and machinery, and the company expect to be manufacturing bagging in time for marketing next year's cotton crop.

Eight or ten years ago, Bessemer steel cut nails were made in Troy and placed upon the market, but it seems that no effort was made to keep up their manufacture. Within a few months, steel nails have again been placed upon the market, and several of our exchanges are telling their readers that such a product is entirely new.

The new illustrated catalogue of the Rollstone Machine Company, of Fitchburg, Mass., has 128 pages, and describes a wide variety of wood-working machinery made by that establishment. They have machines of their make in operation in every State and territory, also in several foreign countries. They furnish complete outfits for wood-working shops of any kind.

A copper bath-tub factory will be in operation in St. Louis about January 1st, as the proprietors, Messrs. Nelson & Tuthill, have already ordered the machinery necessary for that purpose. This manufactory will have the capacity to turn out 600 tubs a month, and will form a new industrial enterprise in St. Louis.—*Stove & Hardware Reporter.*

Two Gardner machine guns have just been completed at the Pratt & Whitney Co.'s works in Hartford, Conn., for General U. S. Grant, as presents to the Viceroy of China and the Mikado of Japan. They are of elaborate workmanship in every part, and the model after which they are made has a government record of 505 shots a minute, and has been fired at the rate of 700 shots a minute, and 5,000 shots in 13 minutes and 26 seconds.

E. E. Garvin & Co., 139-141 Centre Street, New York, have just issued an illustrated catalogue and price list of machinists' tools and special machinery designed and constructed by them. Several new and improved tools and machines have been added since their catalogue was issued last year. During the last year they have increased their shop room and capacity by taking an additional floor and stocking it with new tools. Several pages of general shop information on calculating speed of pulleys, gearing up lathes, &c., are appended to the catalogue.

The Westinghouse Machine Company, Pittsburgh, Pa., do not seem to be troubled much by dullness. In their shops, extra activity is the rule. They made and shipped 73 engines during October, aggregating over 2,200 horse-power, and representing a product of nearly $50,000. Several of these engines were for electric lighting. Others were for a variety of different purposes. They ranged from 125 horse-power down to 10 horse-power. The Reading Coal & Iron Co. alone took one of 80 horse-power, one of 65 horse-power, two of 50 horse-power and one of 40 horse-power, out of the October product. Their customers represent every section of the United States; also some foreign countries.

R. Deeley & Co., E. 32d St., N.Y., have lately shipped a complete new plant of sugar-making machinery to a firm in Cuba. The material weighed upwards of three hundred tons. They have another plant of similar dimensions in course of construction in their shops. They also have some immensely heavy cane-crushing machines partly made, besides some machinery for a refining establishment in Greenpoint. A large cylinder belonging to an air compressor is nearly ready. The firm contemplates making important changes in the shops soon, with the view of facilitating the handling of work.

The Cedar Rapids (Iowa) *Republican* asserts that a paying industry for manufacturing sugar from sorghum could be established in that city, and calls upon capitalists to try the enterprise. It says that the average yield of sorghum is eight tons to the acre, and that farmers all round are ready to begin raising the cane if they had the means of turning it into sugar. The common country sorghum sugar mill is a crude and wasteful machine. To make Western sugar-making a success they require proper machinery that will not leave 25 per cent. of the sugar in the refuse of manufacture.

Elyton Land Company, of Birmingham, Ala., have presented, free of cost, to the Cincinnati, New Orleans & Texas Pacific Railroad a tract of land 700 feet wide by 1,400 feet long, upon which the manager of that road has contracted to put erection shop, car-building shops, &c. It is agreed that every car made for this important road shall be built at the Birmingham shops. The main building is to be 250 feet wide by 400 feet long. The foundry will be 75 by 200 feet. The paint shop, round-house and offices will also be large buildings. It is expected that these shops will give employment to 600 hands.—*Baltimore Manufacturer's Record.*

The *Jeweler's Journal* says: "In looking over the stock book of the Aurora (Ill.) Watch Company, we were surprised to see the interest the trade has taken in it. We notice the names of many of the leading jewelers in nearly every State of the Union. On October 13th, certificates were issued to ten dealers in Nebraska, California, Michigan, Massachusetts, Illinois, Wisconsin, Vermont, Florida and Ohio, making twenty-four shares in all. Work is steadily progressing on buildings and machinery, and everything looks more encouraging for success for the Aurora Watch Company, which has for its motto "Owned and Controlled by the Trade."

A Newcastle, Pa., subscriber sends us the following note: "This city has an estimated population of 20,000. We have four blast furnaces (one of which is furnished with Whitwell stoves made by Witherow & Gordon of this place), two sheet iron rolling mills, two guide mills, three glass works, one paper mill, two flouring mills, and other smaller works of different kinds. Last but not least there are the works of Witherow & Gordon (my present employers), engineers and contractors, builders of blast furnaces and rolling-mill machinery, also general agents for Whitwell Hot Blast Stoves. At present we are building two engines for Pullman Iron & Steel Co., one 30″x48″ and the other 20″x24″, besides running full capacity on hot blast stoves and other general work. The outlook for work this winter is good."

Machinists' Supplies and Iron.

NEW YORK, November 22, 1883.

There is no material change in the supply business, nor nothing indicative of approaching dullness. On the contrary, dealers are inclined to believe that the winter trade will be fairly good, and that the evidences of anything approximating a panic are entirely lacking.

In American iron, while the transactions are by no means satisfactory, the situation appears to be fully appreciated, and future prospects well mapped out. The product will be kept down to the demand, and stock will not accumulate to materially influence future transactions. We quote: No. 1 X Foundry, $20.50 to $21, with some choice brands $0.50 to $1.00 higher; No. 2 X Foundry, $19 to $19.50.

In Scotch pig but little is doing, with prices slightly in buyer's favor. We quote Coltness, $23; Glengarnock, $22; Gartsherrie, $23; Summerlee, $22.50; Eglington, $20.50—all at yard. Prices to arrive slightly lower.

Antimony is a little firmer, with quotations of: Hallett's, 9c. to 9¼c.; Cooksons, 10c. to 10¼.

Copper—Lake, 14⅞c. to 15c.; other brands 14c. to 14½c.

Lead dull at 3.70c. to 3.75c. for common pig.

Spelter—Refined, 8c. to 8¾c., with sales slow.

Tin—Banca, 21½c.; Straits and Malacca, 19¾c. to 19½c.

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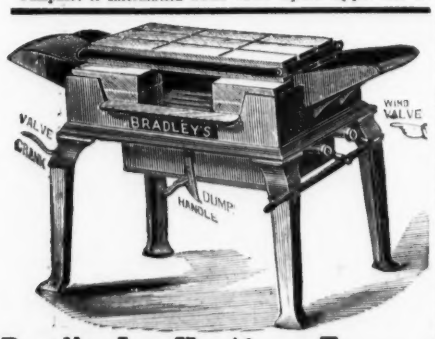

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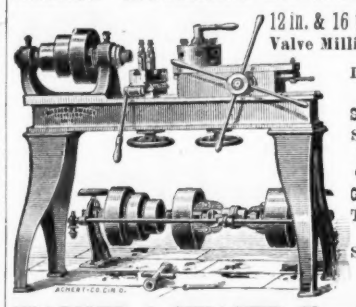
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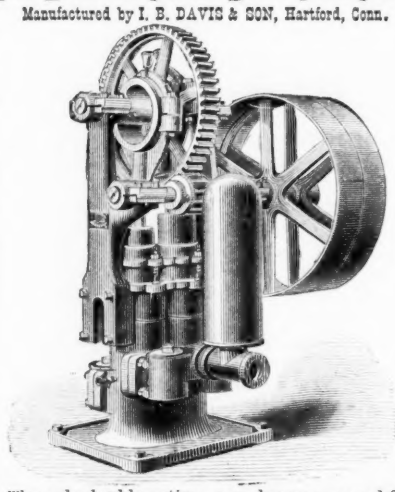
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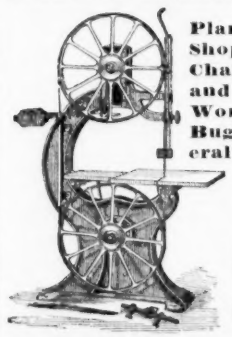
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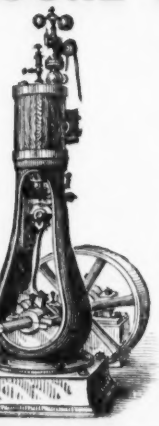
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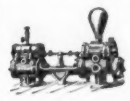
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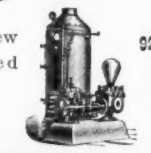
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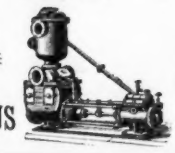

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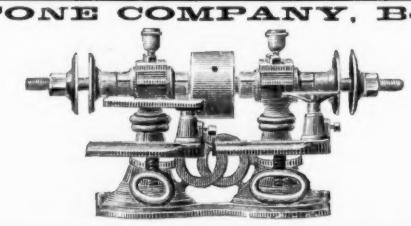
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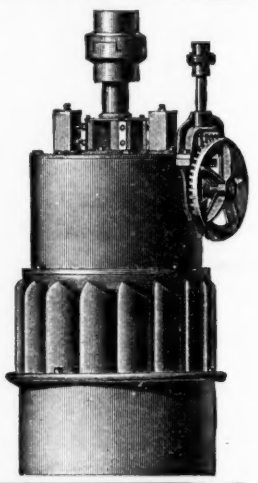

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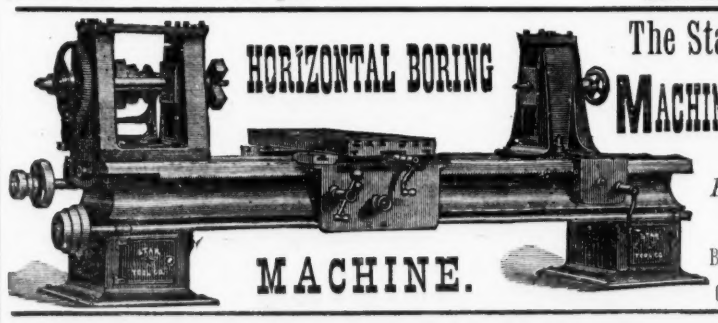
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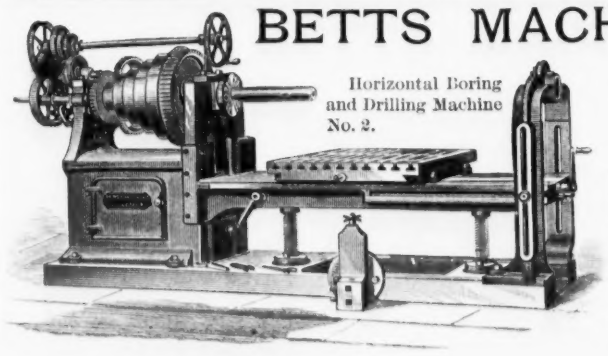
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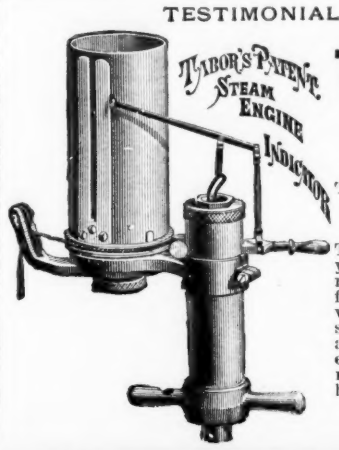

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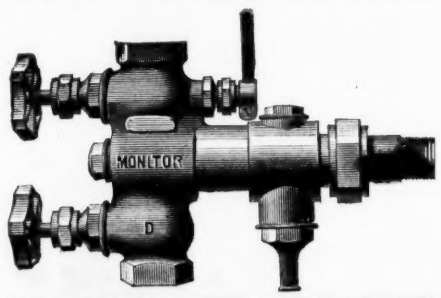

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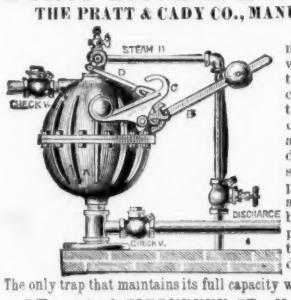

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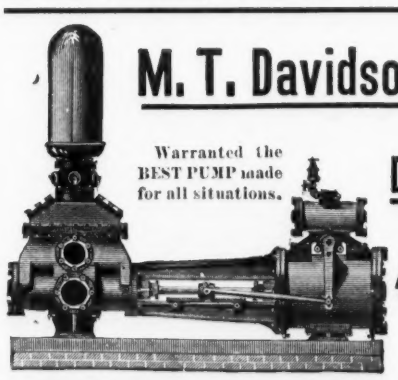

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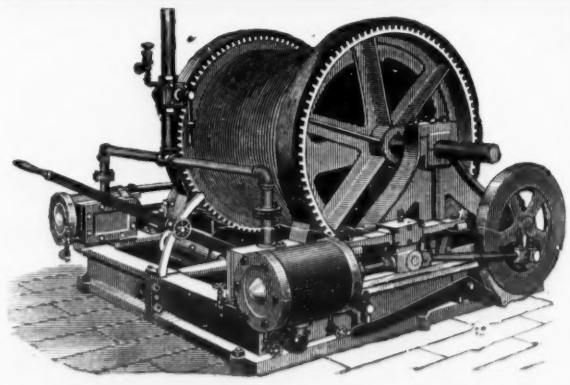

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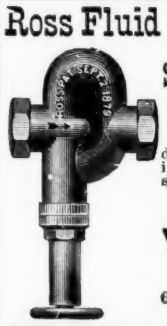

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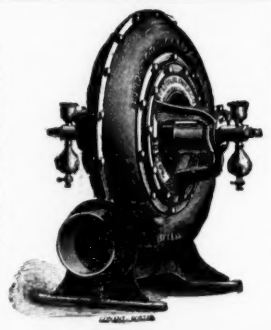

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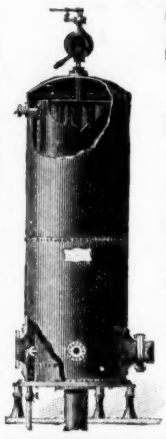

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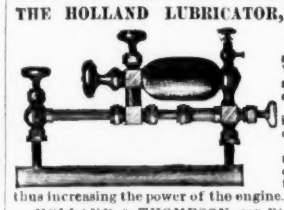

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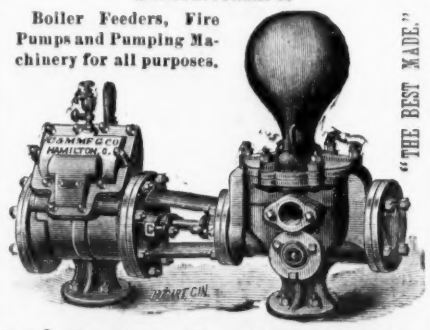

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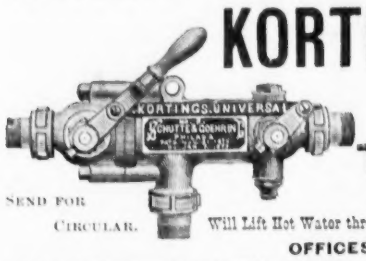

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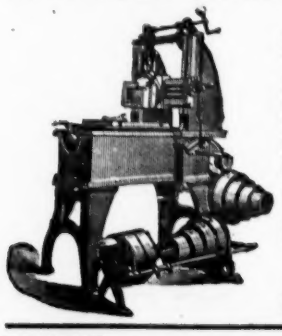

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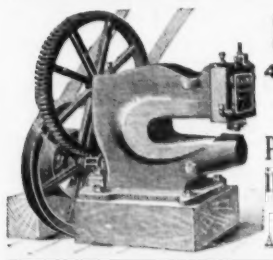

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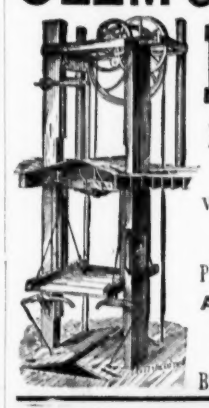

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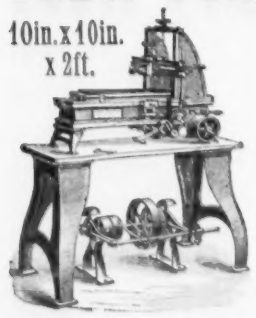

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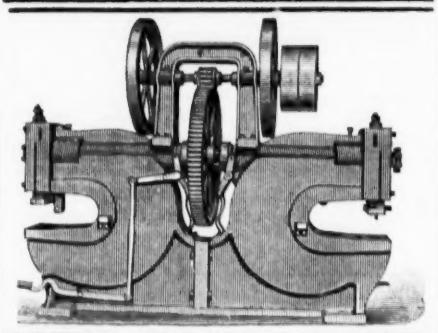

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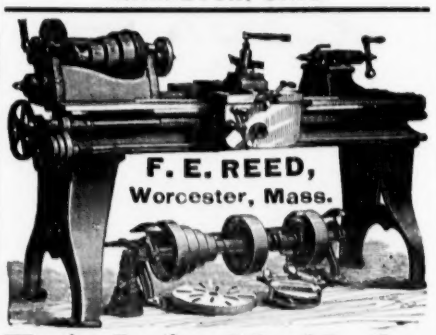

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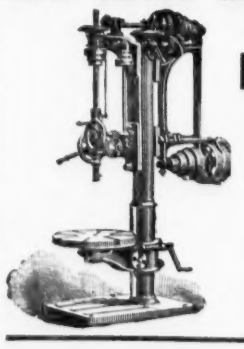

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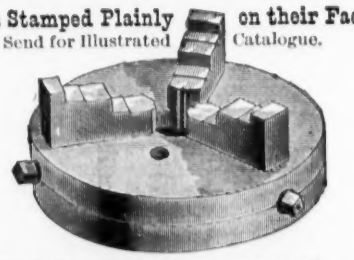

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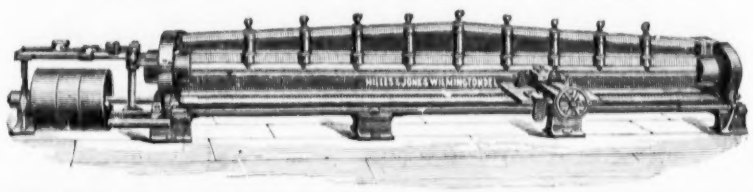

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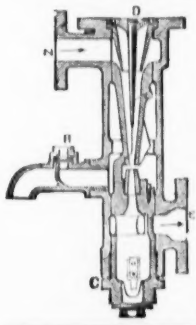

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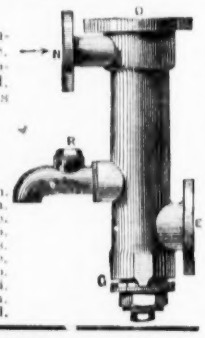

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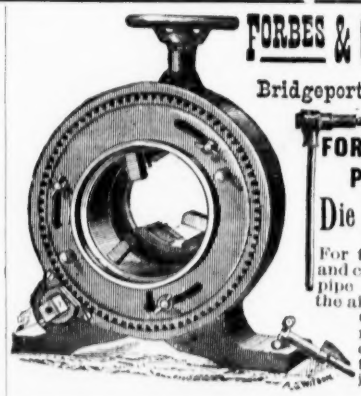

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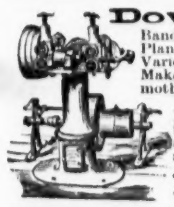

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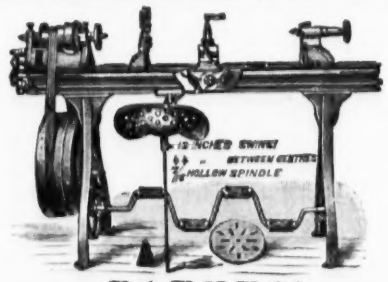

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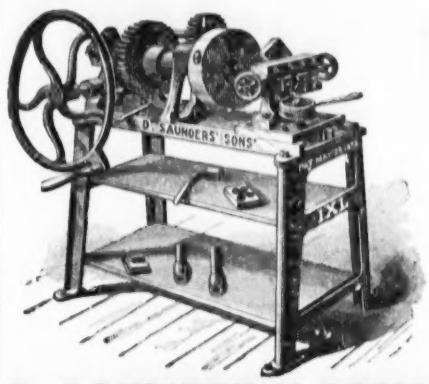

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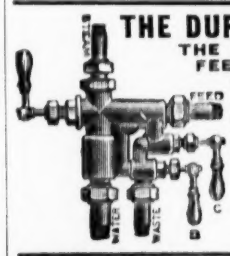

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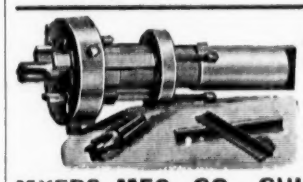

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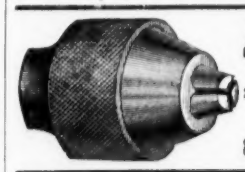

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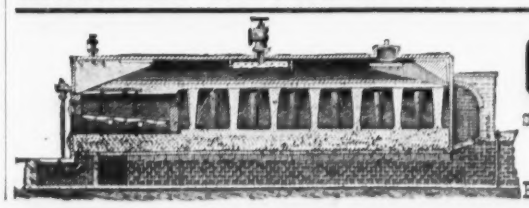

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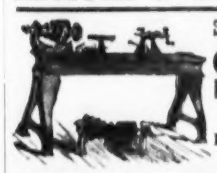

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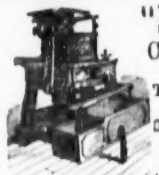

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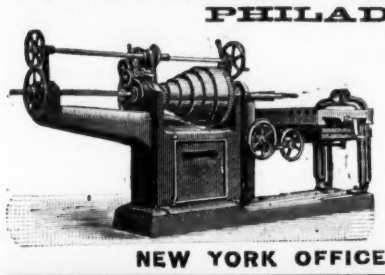

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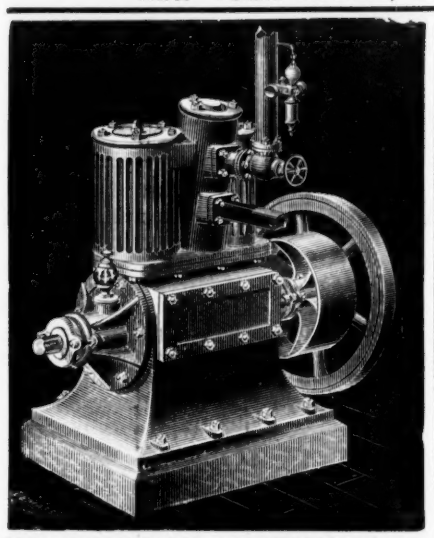

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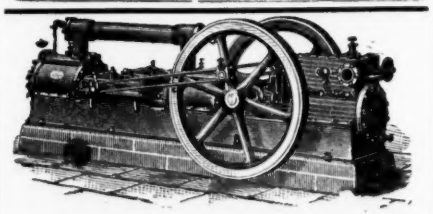

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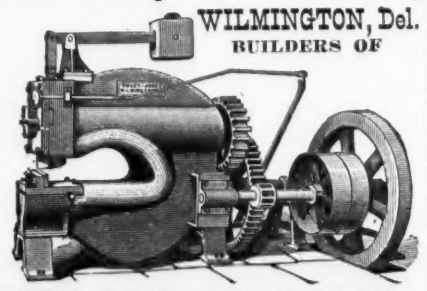

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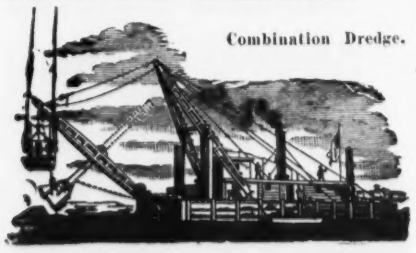

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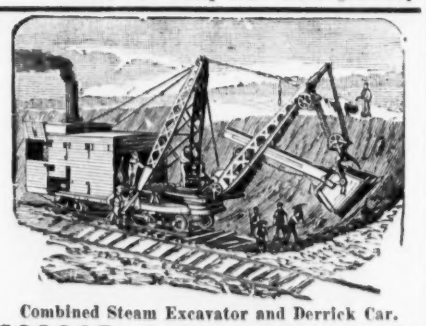

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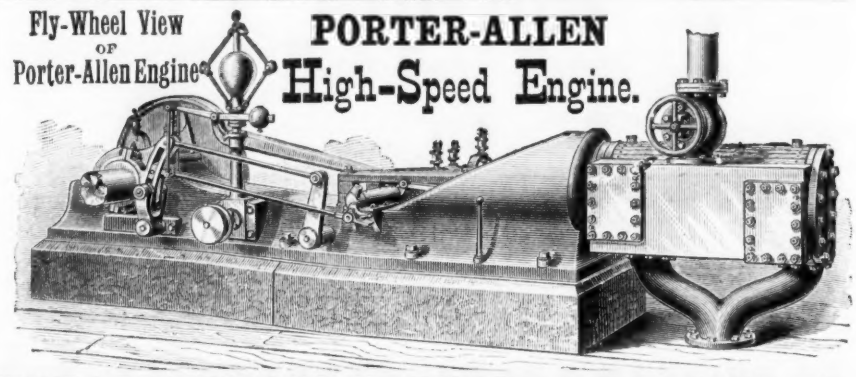

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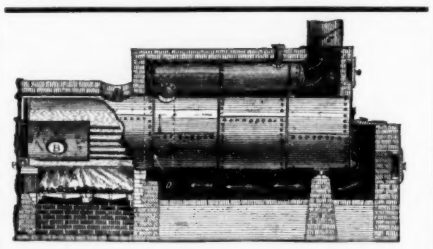

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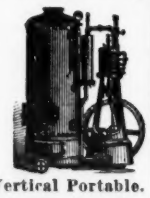

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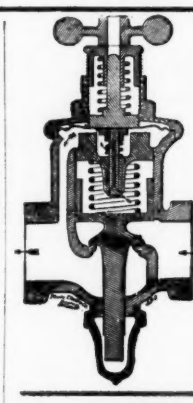

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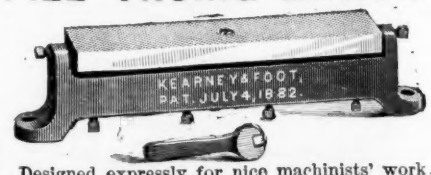

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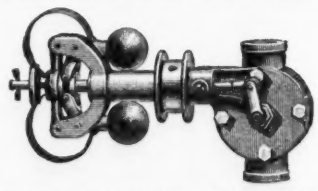

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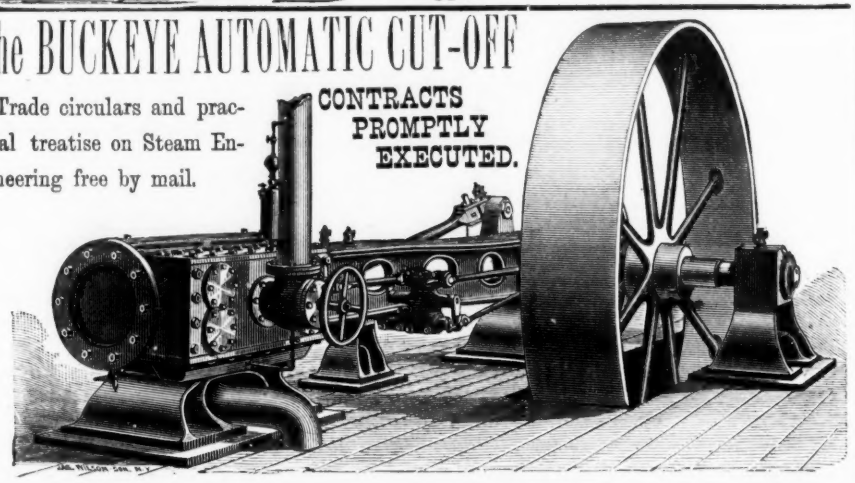

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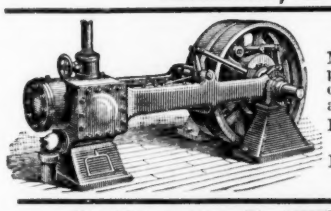

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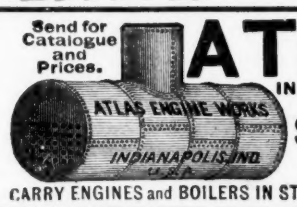

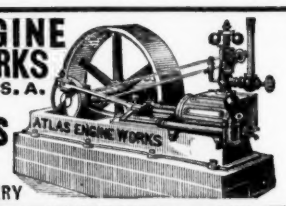

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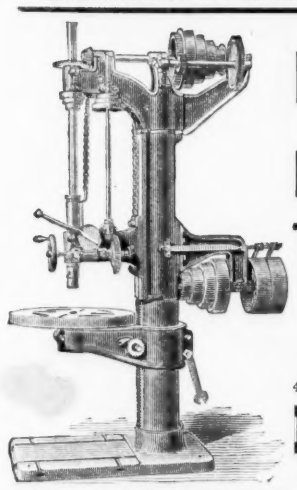

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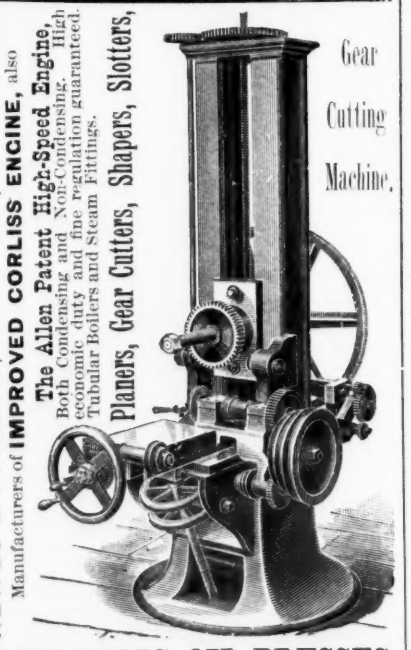

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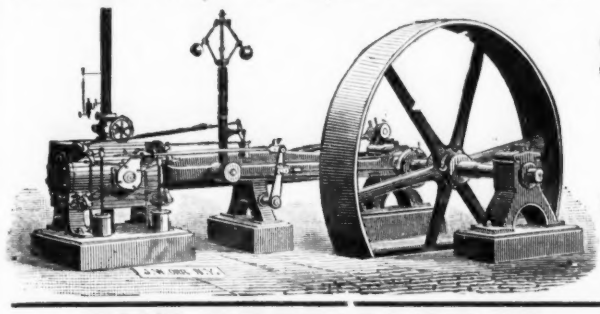

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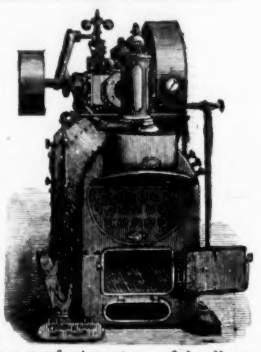

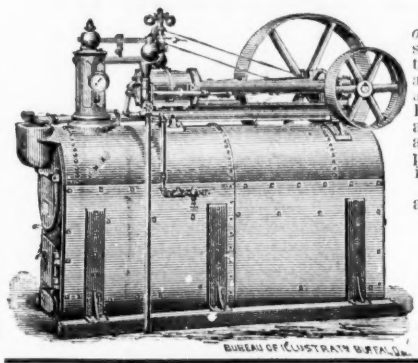

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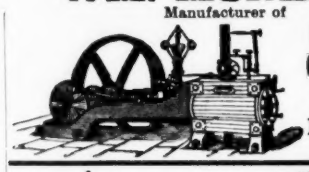

IMPROVED CORLISS ENGINE.
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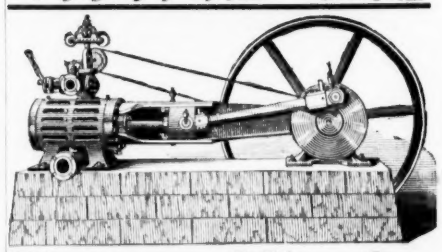

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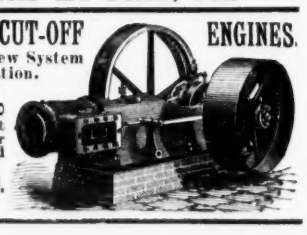

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One Engine Lathe, 20 feet bed, 42 in. swing.
One " 18 " 36 "
One " each 14, 16 and 18 feet bed, 30 in. swing.
One Engine Lathe, each 10 and 12 feet bed, 27 in. swing.
One Engine Lathe, each 8, 10 and 12 feet bed, 23 in. swing.
One Engine Lathe, each 8, 10 and 12 feet bed, 19 in. swing.
One Engine Lathe, 12 feet bed, 20 in. swing.
Three Engine Lathes, 8 feet bed, 18 in. swing.
One " each 6 and 8 feet bed, 16 in. swing.
One Engine Lathe, 5 feet bed, 11 in. swing.
One 3½ feet bed, 10 in. swing, foot power Screw Cutting Lathes,
Two Iron Planers, to plane 8 feet, 30 x 30 in.
One " to plane 7 feet, 26 x 26 in.
Two " to plane 4 feet, 22 x 22 in
One " to plane 3 feet, 18 in. x 16 in.
One each 22, 24, 26, 30 and 38 in. swing B. G. S. F Upright Iron Drills.
One Shaper, 15 in. stroke.
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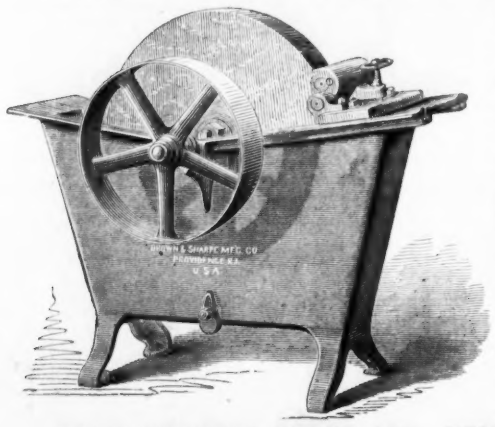
IMPROVED GRINDSTONE TROUGH.



This cut represents a grindstone trough combining a number of very desirable qualities. In addition to the ordinary arrangement of trough, spindle, and pulley, it is provided with self-oiling boxes and an adjustable truing device which can be instantly applied to the face of the stone, working automatically, and without dust, keeping the face of stone always in good shape without interfering with its constant use.

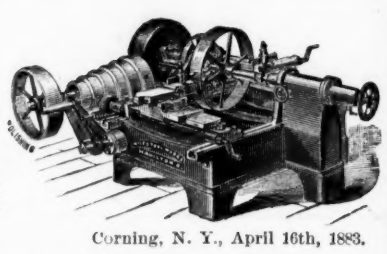
DIRECTIONS.—The stone should revolve so as to have the device upon the face which moves upwards. The main stand or bottom piece of the device is securely clamped upon the trough close to the face of the stone, then by turning the hand wheel the threaded roll is brought into contact with the face of the stone and allowed to remain as long as is requisite to produce the desired result. The water is to be left in the trough as usual. When by long use the thread on the hardened roll becomes worn, it can be re-cut, which operation may be repeatedly performed,

Weight 600 pounds; with 40-inch stone, 1,000 pounds.

PRICE, WITHOUT STONE, $80. PRICE, STONE INCLUDED, $95.

SPECIAL PULLEY MACHINERY

36, 50 & 60 inch swing.



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WESTON'S PATENT POWER TRAVELING CRANES

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Particulars on application and full specification and tender promptly submitted on receipt of capacity and span of bridge desired.

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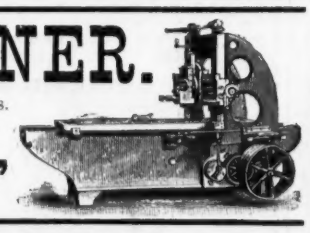

26 in. x 26 in. x 6¼ ft, wt. 7,000 lbs. 26 in. x 26 in. x 8½ ft., wt. 8,200 lbs.

New Descriptive Circular now ready.

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FIRST-CLASS PLANERS.

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Have Ready for Delivery:

Drilling Machines—No. 2 Upright, No. 3 Vertical; Nos. 1 and 3, Manufacturers and Manufacturer's Bench; Champion Drills; No. 0 Gang Drills, 10 in. Pillar Shapers. 1, 14 in. Shaping Machine; Hand Lathes, 8, 12, 15 and 18 in. swing; Cutting-off Lathes for 4½ in. diameter. Revolving Head Screw Machines, Nos. 1 and 3; Hand Milling Machines, Nos. 1, 2 and 3; Power Milling Machine, Nos. 2 and 3; Bolt Cutters, Turret Head, Nos. 2, 3 and 4; National, Nos. 2, 3 and 4. Nos. 1 and 2 Screw Shaving Machines; No. 1 and 2 Screw Slotting Machines; 13 in. Plain Engine Lathes; 16 in. Weighted and 19 and 21 in. Gibbed Screw Cutting Lathes. One Double Connection Power Press. Index Milling Machines. Nos. 2 and 3 Horizontal Tapping Machines. Cutter Grinders. 20, 24, 26, 34 and 40 in. Planers. Drill Grinding Machines. No. 2 and 3 Die Sinkers; 10 and 18 in. Lead Tapping Machines; 18 and 38 in. Chucking Machines; Nut Tapping Machines. **Have increased discount on Combination Lathe Chucks;** quotations on application.

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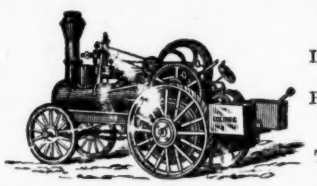

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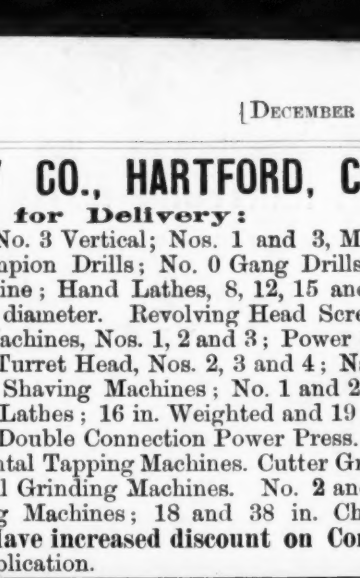

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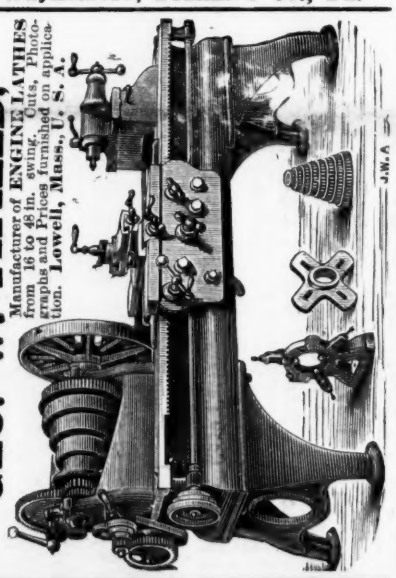

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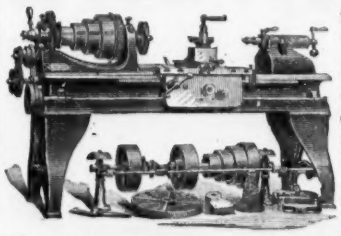

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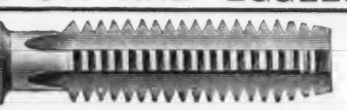

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